Imperial Bureau of Plant Genetics

(For Crops other than Herbage)

Plant Breeding Abstracts

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Note.—Initialled abstracts are written by the following :

Dr. A. Buchinger	A. B.
Dr. H. M. Leake	H. M. L.
Dr. J. Wishart	J. W.

* General studies, see also individual crops.

Plant Breeding Abstracts.

Vol. VII, No. 1.

Part I. British Empire

STATISTICS 519

1. BARTLETT, M. S. 519.24
A note on the analysis of covariance.
J. Agric. Sci. 1936 : **26** : 488–91.
A short article summarizing the cases in which a covariance analysis may be used, and the nature of the problems on which such an analysis may throw light, together with remarks on the interpretation of significant results obtained by the method. J. W.

2. BARTLETT, M. S. 519.24
The square-root transformation in analysis of variance.
Suppl. J. R. Statist. Soc. 1936 : **3** (1) : 68–78.
In spite of the wide range of applicability of the direct use of the analysis of variance, data sometimes occur which are more validly analysed on another scale. When the standard error of a variate is proportional to its mean value the logarithmic transformation suggests itself, while if the variance is proportional to the mean, the square-root transformation may be considered. The latter transformation is considered in some detail in this paper, since it is of frequent value for analysing field variation of a Poisson type. Examples are given of data for which it has been of use. Variation of the binominal type is also considered. J.W.

3. MATHER, K. 519.24
The combination of data.
Ann. Eugen. 1935 : **6** : 399–410.
A rule for the application of the method of maximum likelihood to the calculation of statistics from combined sets of data is formulated and its use illustrated by examples taken from genetical data. The calculation of the standard errors and the testing of the homogeneity of the different sets of data are also illustrated.

4. WISHART, J. 519.24
Tests of significance in analysis of covariance.
Suppl. J. R. Statist. Soc. 1936 : **3** (1) : 79–82.
It is sometimes necessary to compare group means after adjustment for regression by means of a covariance analysis. The standard error of a difference between two such corrected means has been given, but only for the case of a single independent variate. In this paper the formula is worked out for the general case of any number of independent variates, and an example of its use in an agricultural experiment is given. J. W.

5. COCHRAN, W. G. 519.24:635.64–2.8
The statistical analysis of field counts of diseased plants.
Suppl. J. R. Statist. Soc. 1936 : **3** (1) : 49–67.
When an examination has been made of every plant in a field or greenhouse for symptoms of disease there are questions of disease distribution and neighbour infection to be considered. In discussing the statistical analysis of such data the author works out tests of significance to examine on the one hand whether diseased plants tend to congregate in patches scattered over the area or in groups along or across the rows, and on the other hand whether, where more than one disease count has been made, the distribution of plants recently infected is related to that of plants previously infected. A further test is designed to detect the spreading of infection from neighbour to neighbour in a row. The tests are illustrated by means of observations on spotted wilt of tomatoes. J. W.

GENETICS 575

6. BELL, G. D. H. 575:633
Crops and plant breeding.
J. Roy. Agric. Soc. Eng. 1935 : **96** : 159–99.
The breeding problems reviewed in this annual survey are concerned with grassland, winter hardiness, drought resistance and windburn and with oat breeding. Most of the material, apart from that dealing with herbage, has been reviewed in " Plant Breeding Abstracts".

7. HALDANE, J. B. S. 575.123:575.148
The amount of heterozygosis to be expected in an approximately pure line.
J. Genet. 1936 : **32** : 375–91.
Two sources of heterozygosis are considered, namely, that retained from the original ancestors and that due to mutation. The respective amounts of heterozygosis due to these two causes are calculated for selfed diploids, including autosomal and sex-linked genes, and selfed autotetraploids.

8. 575.41
A discussion on present state of the theory of natural selection.
Proc. Roy. Soc. 1936 : **121** : Ser. B No. 820 : 43–73.
An address by Prof. D. M. S. Watson followed by contributions from the exponents of various theories bearing on the subject of natural selection and inheritance.

9. 575.41:576.12
The present state of the theory of natural selection.
Nature, Lond. 1936 : **137** : 876–77.
The report of a discussion held by the Royal Society on May 14th, 1936 mentioned in Abst. 8.

CYTOLOGY 576.3

10. MATHER, K. 576.354.46
Competition between bivalents during chiasma formation.
Proc. Roy. Soc. 1936 : **120** : Ser. B No. 817 : 208–27.
Negative correlations were found to occur between the chiasma frequencies of different bivalents in some species and not in others, the material used covering a wide range of plants and insects. The mode of occurrence of these correlations suggests that where they occur there is an upper limit of chiasma frequency per nucleus and that the formation of a chiasma in one bivalent reduces the chance of one occurring in another bivalent, a phenomenon referred to as " competition ".

AGRICULTURE 63

11. 63.0015
Imperial Agricultural Research.
Trop. Agriculture, Trin. 1936 : **13** : 141–43.
Urging the need for another Imperial Agricultural Research Conference to be held in 1937, this article reviews some of the topics which might be dealt with at such a conference.

FIELD TESTS 631.421

12. YATES, F. 631.421
A new method of arranging variety trials involving a large number of varieties.
J. Agric. Sci. 1936 : **26** : 424–55.
The ordinary methods of randomized blocks and the Latin Square become impracticable when the number of varieties to be tested is large. A possible method is to divide the varieties into sets, keeping one as a control, each set being arranged with the controls in a number of randomized blocks. Comparisons between varieties in different sets are, however, of lower accuracy than

comparisons in the same set. Alternatively a number of controls may be interspersed systematically among the varieties, and a fertility measure calculated for each plot. Comparisons may then be made by using this fertility measure as a concomitant observation. The amount of land that has to be given to the control in any such experiment tends, however, to lower its efficiency, and in an attempt to avoid the various defects of such methods, and at the same time to avoid the use of excessively large blocks, a *pseudo-factorial* type of arrangement is suggested. The varieties are divided into sets for comparison in more than one way, the sets of each division being so arranged that they cut across those of all the other divisions. The paper discusses in detail the analysis and efficiency of the different types of arrangement that are possible. The appropriate methods of computation are illustrated by numerical examples based on the results of a uniformity trial on orange trees. It is shewn that pseudo-factorial arrangements are likely to be more efficient than arrangements involving the use of controls, and in cases where there is considerable soil heterogeneity they are also markedly more efficient than randomized blocks containing all the varieties. J. W.

13. KULKARNI, R. K., BOSE, S. S. and MAHALANOBIS, P. C. 631.421:633.174
Statistical notes for agricultural workers. No. 17. On the influence of shape and size of plots on the effective precision of field experiments with Juar (*Andropogon Sorghum*).
Indian J. Agric. Sci. 1936 : **6** : 460–74.

One acre of land was chosen out of a larger area for sowing Maldani juar, and harvested for three years in plots of 1/160 acre. This uniformity trial enabled a statistical analysis to be carried out to determine the most effective size and shape of plot. The frequency distributions of yields did not depart greatly from normality. The precision was found to be greatly improved by dividing the area into blocks. Long narrow plots gave greater precision than wider plots of the same area. The standard deviation between plots decreased as the plot area was increased, but the gain in precision was less than the loss due to the reduction in the number of replications. A correction for size of plot and number of replications enabled an index of effective precision to be calculated. This was highest in plots of 290 feet x 3·75 feet (1/40 acre). Plots half as long but the same width came next. No appreciable correlation in yield was found from year to year. J.W.

PLANT DISEASES 632

14. MITTER, J. H. 632.4:577.8
Presidential address, Indian Botanical Society, 1936. Some recent contributions to our knowledge of heterothallism in fungi.
J. Indian Bot. Soc. 1936 : **15** : 183–92.

A review summarizing the more important work on heterothallism in the different groups of fungi.

15. 632.42:576.16:575.242:633.1
PADWICK, G. W. 633.1–2.42–1.521.6:575
Biologic strains of *Ophiobolus graminis* Sacc.
Ann. Appl. Biol. 1936 : **23** : 45–56.

Isolates of *O. graminis* obtained from different sources and different hosts shewed differences in cultural characteristics on artificial media. Saltation was observed in one culture, the new form producing abundant black macrohyphae as compared with very few in the original form.
Different isolates shewed differences in pathogenicity sufficient to warrant describing them as strains, but the differences were parallel over a series of hosts. Thus, those causing the greatest reduction in length of plant on *Triticum Spelta* also caused the greatest reduction in other *Triticum* species and in *Hordeum vulgare*. Conversely those hosts which were most resistant to a given isolate were more resistant to the rest. None of the varieties used offered any marked degree of resistance.
The difficulties of breeding for resistance to such unspecialized fungi are discussed and it is suggested that the failure to find resistant varieties of common wheat may be due to the exceptionally heavy inoculations given and, in part, to the manner in which data have been taken.

16. 632.452:576.16(94.4)
633.11–2.452–1.521.6

WATERHOUSE, W. L.

Some observations on cereal rust problems in Australia.

Proc. Linn. Soc. N.S.W. 1936 : **61** : 5–38.

After a consideration of the history of the problem, physiological specialization in the different cereal rusts in Australia is described, the results of surveys of prevalent forms being given. Finally control measures are treated, emphasis being placed on the breeding of resistant varieties. A tribute is paid to William Farrer for his breeding work with Australian wheats.

17. 632.452:576.16:633.11(42)
632.452:575.242

ROBERTS, F. M.

The determination of physiologic forms of *Puccinia triticina* Erikss. in England and Wales.

Ann. Appl. Biol. 1936 : **23** : 271–301.

From 43 collections of *P. triticina* from England and Wales eight new physiological forms (66–73) and one previously recorded one (15) were obtained. Two new forms (74 and 75) were also isolated from collections sent from Portugal.

From an apparently pure collection of form 66 a form resembling form 10 was obtained, probably by mutation. This fact and the apparent absence of an aecidial host on which hybridization could occur suggest that the multiplicity of new forms occurring in England and Wales is due to mutation.

Form 66 appears to be most widespread among the collections studied, followed by form 15 which also occurs in continental Europe and the U.S.A.; the latter form was also recorded during the present investigation, from Portugal.

Form 66 appears to be inherently instable, judged by the apparently spontaneous changes which occur in the reaction of the variety Hussar to it. Changes in the reaction of some of the differential varieties used to certain physiological forms were found to be associated with environmental changes, increased susceptibility following increased light intensity and temperature. Infection of some varieties by *Erysiphe graminis* resulted in the formation of susceptible type pustules by certain forms to which the varieties were normally resistant.

18. JARY, S. G. 632.951.1:575.42(42)

Pyrethrum.

J. S.-E. Agric. Coll. Wye 1936 : No. 38 : 59–66.

Six different types have been selected from material grown from French seed and are being propagated vegetatively. They have also been propagated by seed and it was found that about 70 per cent of the resulting plants conformed to the parent type.

WHEAT 633.11

19. 633.11 Bansipalli 808
633.11:575(54.7)

KADAM, B. S.

A new variety of wheat.

Curr. Sci. 1936 : **4** : p. 833.

A new strain of winter wheat, *Triticum durum* Desf., Bansipalli 808 has been released by the Bombay Presidency Department of Agriculture for the Nasik district. It was obtained from a cross between the improved Bansi strain 168, and Kala-Khapli 568, ripens about a fortnight earlier than the local wheat and is superior in yield and quality. It has white glumes and awns, unlike either parent.

20. 633.11:00.14
633.11 Rooi-kleinkoring
633.11 Wit-kleinkoring

SMUTS, I. J.

Wheat varieties that are identical. The case of Rooi- and Wit-kleinkoring and Lalkasarwali and Kasarwali.

Fmr's Wkly 1935 : **49** : p. 1483.

Considerable confusion in nomenclature has arisen and it is recommended that the names Rooi- and Wit-kleinkoring be adopted on grounds of priority.

These are two valuable varieties, being early, moderately rust-resistant and high-yielding and giving flour of good baking quality. The ease with which their grain can be recognized will also be a valuable feature if a separate grade for high baking quality is introduced ; this also applies to the variety Marquis.

21. ARMSTRONG, J. M. 633.11:575.127.5:633.289:575.115

Hybridization of *Triticum* and *Agropyron*. I. Crossing results and description of the first generation hybrids.

Canad. J. Res. 1936 : **14** : Sect. C : 190–202.

The wheat forms used were the tetraploids *T. dicoccum* var. Vernal Emmer and *T. durum* var. Mindum and the hexaploid *T. vulgare* varieties Lutescens (spring wheat) C.A.N. 1835 (spring wheat, an F_6 segregate from Pentad x Marquis) and Kharkov (winter wheat). The *Agropyron* species which were successfully used as male parents were *A. glaucum* (2n = 42) and two strains of *A. elongatum* (2n = 70). No success was obtained in crosses involving eight other *Agropyron* species or in crosses in which wheat was the male parent.

The success in crossing depended on the species and strains used, the average being about 10 per cent. Germination was on the whole quite good.

The F_1 plants were studied with special reference to the question of dominance. In general the hybrids were self-sterile and intermediate, but there was a strong tendency to dominance of *Agropyron* characters. Of great practical importance is the dominance of the perennial habit.

Of theoretical interest is the different behaviour of the characters awned-awnless and keeled glume-not keeled in crosses of wheat with the two Agropyron species, for there was greater dominance of *Agropyron* characters in *A. elongatum* crosses than in *A. glaucum* crosses.

The significance of the results in relation to theories of dominance is discussed and it is considered that the results conform better with Wright's theory (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 47) than with Fisher's (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 86).

22. 633.11:575.127.5:633.289:576.354.4

PETO, F. H. 633.289:576.354.4:576.356.5

Hybridization of *Triticum* and *Agropyron*. II. Cytology of the male parents and F_1 generation.

Canad. J. Res. 1936 : **14** : Sect. C : 203–14.

A report on meiosis in the *Agropyron* forms and the F_1 hybrids in the article reviewed in Abst. 21.

In *A glaucum* (2n = 42) ten pollen mother cells analysed gave an average of $1{\cdot}4_{I} + 19{\cdot}9_{II} + 0{\cdot}2_{IV}$. Pairing was more complex in *A. elongatum*, ten cells of which gave an average of $2{\cdot}0_{I} + 22{\cdot}1_{II} + 0{\cdot}6_{III} + 3{\cdot}0_{IV} + 0{\cdot}2_{V} + 0{\cdot}7_{VI} + 0{\cdot}6_{VIII}$, the notable features being the preponderance of associations with an even valency and the occurrence of octovalents in a naturally occurring species.

From 20 pollen mother cells of the cross *T. dicoccum* var. Vernal x *A. glaucum* an average was obtained of $20{\cdot}4_{I} + 6{\cdot}2_{II} + 0{\cdot}8_{III}$ while from *T. durum* var. Mindum it was $22{\cdot}0_{I} + 5{\cdot}5_{II} + 0{\cdot}5_{III} + 0{\cdot}05_{IV}$. The occurrence of 5 to 6 bivalents indicates partial homology between one of the *Triticum* sets A or B and one of the *A. glaucum* sets.

In the crosses of the hexaploid varieties Lutescens and Kharkov with *A. glaucum* the chief difference as compared with the above crosses was an increase in the number of univalents, the frequency of bivalents being approximately the same. The cross C. A. N. 1835 x *A. glaucum*, however, gave an average of only 1·2 bivalents per nucleus, no pairing at all being observed in eight of the twenty cells examined.

Of the tetraploid *Triticum* x *A. elongatum* crosses only the Vernal cross was examined cytologically. Different collections gave different results, one giving an average of $6{\cdot}6_{I} + 12{\cdot}1_{II} + 3{\cdot}6_{III} + 1{\cdot}1_{IV} + 0{\cdot}6_{V}$ and the other $17{\cdot}7_{I} + 8{\cdot}3_{II} + 3{\cdot}0_{III} + 0{\cdot}7_{IV} + 0{\cdot}6_{V}$. This is believed to be an instance of genetic limitation of pairing, probably due to intervarietal differences in one or other of the parents.

Pairing was again very complex in the hexaploid *Triticum* x *A. elongatum* hybrids, all the associations found in *A. elongatum* occurring also in the hybrids though with different frequencies

there being relatively more with odd valencies. Further evidence will be needed before the proportons of allo- and autosyndesis can be estimated.
In the discussion the discrepancies between the author's results and those of Vakar, Krot and Brekina (Cf. " Plant Breeding Abstracts," Vol V, Abst. 969) are attributed to faulty interpretation by the Russian workers. The significance of genetic control of pairing is pointed out and also the possibility of structural changes causing a limitation of pairing in the hybrid C.A.N. 1835 x *A. glaucum*, the wheat parent in this case being an F_6 from the cross *T. durum* var. Pentad x *T. vulgare* var. Marquis.
The possible origin of *A. elongatum* is then discussed and two alternatives are propounded, the more feasible being that it results from a cross between a hexaploid like *A. glaucum* and a tetraploid *Agropyron*, with subsequent chromosome doubling ; in the other alternative a different *Agropyron* hexaploid and a tetraploid wheat are the putative parents.

23. HARRINGTON, J. B. 633.11–2.111–1.521.6:575.11
The reaction of wheat hybrids to a spring frost.
Canad. J. Res. 1936 : **14** : Sect. C : 185–89.
The degree of injury of certain hybrid lines of wheat was studied after a spring frost occurring on June 4th, 1935 at Saskatoon, Sask. F_5 lines from the cross H–44–24 x Reliance and F_6 lines from the cross (Reliance x Reward) x Reliance were, on the average, intermediate between the parents, but lines possessing the same degree of resistance as either parent could be picked out in each case. Purified lines of three new stem rust resistant varieties, Apex, A277 and A41, were also studied. The varieties all spring from the cross (H–44–24 x Double Cross) x Marquis but shewed different degrees of resistance, significant differences also being found between lines of the same variety.
Discussing the results, the importance of testing for frost resistance is emphasized, particularly when varieties lacking it are used in hybridization to introduce some other valuable character.

24. 633.11–2.452–1.521.6:575
633.11 Pusa 120
SHAW, F. J. F. and PAL, B. P. 633.11 Pusa 165
Pusa 120 : a wheat highly resistant to yellow rust.
Agric. Live-Stk. India 1936 : **6** : 202–03.
Produced from a cross between Pusa 52 and Federation, Pusa 120 is a stiff-strawed bearded wheat which tillers well, has attractive grain and is resistant to all the three forms of yellow rust occurring in India and to one of the two forms of brown rust. It has, however, a tendency to shed its grain when ripe and is likely to be of greatest value as a parent in the attempt to breed a wheat resistant to all the rust forms occurring in India, which has been recently started at Pusa.
Another new Pusa wheat, Pusa 165 was bred at the same time as P. 120, from a cross between P. 4 and Federation. It is a stiff-strawed beardless wheat with attractive grain and a considerable degree of rust resistance in the field, though it is less resistant to yellow rust than P.120; it is one of the highest yielding wheats in India.

25. CALLAGHAN, A. R. and BREAKWELL, E. J. 633.11:664.641.016:575(94.2)
Activities at Roseworthy College, 1934–35. Part III. Progress in the improvement of the baking quality of South Australian wheat.
J. Dep. Agric. S. Aust. 1936 : **39** : 1112–23.
Largely owing to concentration on yield in breeding new varieties, the quality of Australian wheat has declined, with a consequently reduced demand in other countries.
The first measure in the improvement of quality is to check the cultivation of very weak wheats, the second being the development of new varieties of higher quality. In both these activities Roseworthy College is playing its part.
The work on the development of new varieties consists of three main parts ; firstly testing new varieties from other states and countries, which has led to the introduction of Dundee and possibly in the near future of Baringa ; secondly, selection for quality within existing varieties, a method which promises well with Ford and Sword ; thirdly, the chief method, hybridization.

Crosses have been made in the past three years between such high quality wheats as Pusa 4, Dundee, S.H.J., Carrabin, Dindiloa and others which possess some desirable characters, and the common low quality, high-yielding varieties, such as Sword, Ghurka, Gallipoli, Waratah, Nabawa and so on. Selection begins in the second year and every line possessing desirable agronomic characters is tested by the Pelshenke method in the third year, those below a fixed standard being rejected. Selection for quality, yield, disease resistance, and so on, continues to about the sixth generation when testing for yield on a field scale commences. In addition to the Pelshenke method, a Rotor Gluten Washing Apparatus is being standardized for future use in the determination of quality and further apparatus for milling and baking tests is needed. The inheritance of baking quality is also being studied. It has been found that some high quality wheats can transmit the character better than others, that some are more subject to environmental conditions than others, a character which appears to be inherited to some extent and also that the appearance of the fracture of the grain is not a reliable criterion of quality.
The influence of environment on quality is being studied by growing samples of a pure line of Ford on a large number of different farms.

OATS 633.13

26. 633.13:575(41)
633.16:575
633.65:575.42

Agricultural research in Scotland in 1935. Being a brief summary of work at the Scottish Agricultural Research Stations during the year.
Trans. Highl. Agric. Soc. Scot. 1936 : **48** : Ser. 5 : 166–82.

A report on the work on cereals at the Scottish Plant Breeding Station at Corstorphine is included.
A brief account of the new oat Early Miller is given. Resistance to lodging and freedom from blast or blindness are being sought in the breeding work now in progress. Crosses with huskless oats have also been made to see whether it is possible to evolve a huskless oat suitable for growing in Scotland.
Common Scotch barley is being subjected to pure line selection with the object of selecting the best of the mixture of types of which it consists. Hybridization is also performed in barley for securing high-yielding, attractive grain types resistant to lodging. An awnless six-rowed type has been used as parent and its hybrid progenies will be examined for promising awnless types. Single plant selections have been made from varieties of field beans grown for observation. Some of the hardier varieties of soya beans are being tried.

27. 633.13:581.48:575(42)

Husk-free oats.
Qd. Agric. J. 1936 : **45** : p. 521.

Brief mention is made of the reported success in breeding a huskless oat by Messrs. Parker and Proctor of Bakingley, King's Lynn, Norfolk, and of the striking advantages of such an oat.

28. McConnell, P. 633.13:581.48:575(42)

Some general farm notes. A new huskless oat.
N.Z. Fmr. 1936 : **57** : p. 346. col. 4.

Mention is made of a huskless oat, bred by Mr. W. Parker of King's Lynn, Norfolk. It is claimed to give more than double the financial return per acre of ordinary pedigree oats.

29. Western, J. H. 633.13–2.451.2–1.521.6

The biology of oat smuts. IV. The invasion of some susceptible and resistant oat varieties, including Markton, by selected biological species of smut. [*Ustilago Avenae* (Pers.)] Jens and *Ustilago Kolleri* (Wille).
Ann. Appl. Biol. 1936 : **23** : 245–63.

Three different mechanisms of resistance were found, each characteristic of particular combinations of oat variety and physiological form ; resistance may be due to a failure of the fungus to penetrate the epidermal cell of the host, to a hypersensitive reaction somewhat similar to that occurring in wheat rust or, most commonly, to a restriction of the growth of the mycelium which allows the growing point to escape infection.

BARLEY 633.16

30. 633.16:575(48.5)
633.16:581.192:663.421
633.16–2.6–1.521.6

LUNDIN, H.

Some recent theoretical and practical Swedish contributions to the brewing industry.

J. Inst. Brew. 1936 : **42** : 273–92.

An extensive survey including a review of breeding work. Improved malting varieties of barley have been bred, in particular at Svalöf, by pure line selection and by hybridization, including the utilization of transgressive segregation. Strains are still being produced including some resistant to nematode attack (*Heterodera Schachtii*) ; this resistance has been found to be connected with the presence of an indole base called gramin. The best varieties at present in use lack resistance to smut and rusts (*Puccinia glumarum* and *P. simplex*).

Field trials have been performed to determine yielding ability and malting quality.

Another important aspect of the work in Sweden is the study of chemical characteristics of barley and malt and varietal differences have been noted in respect of a number of important characters, such as amylase content and relation between extract content of the malt and of the barley.

MILLETS AND SORGHUMS 633.17

31. 633.171:581.46:575.11–181.12

RANGASWAMI AYYANGAR, G. N. and ACHYUTHA WARIAR, U.

Inheritance of glume length in ragi, *Eleusine coracana* (Gaertn.), the finger millet.

Madras Agric. J. 1936 : **24** : 132–34.

An African variety of ragi having long glumes as compared with the normal Indian varieties was crossed with one of the latter. The F_1 had short glumes and the segregation in F_2 and F_3 indicated the presence of three dominant factors, Gl_1, Gl_2 and Gl_3, all three of which are necessary to produce short glumes. Any two together produce medium glumes while one or none gives the long type of glume. This type of interaction gives an F_2 segregation into 27 short : 27 medium : 10 long.

32. 633.174:581.46

RANGASWAMI AYYANGAR, G. N. and VENKATARAMANA REDDY, T.

Additional data on the homology of stigmas and awns.

Curr. Sci. 1936 : **4** : 817–19.

Two cases are described in which abnormalities in the pubescence of stigmas were accompanied by parallel abnormalities in the barbing of awns. A third case involved the production of stigmatic areas on awns.

33. 633.174:581.48

RANGASWAMI AYYANGAR, G. N., PANDURANGA RAO, V. and VENKATARAMANA REDDY, T.

Cracked grains in sorghum.

Curr. Sci. 1936 : **4** : p. 874.

Cracking of the pericarp is a character which has been encountered in several African races and it appears to be inherited. The behaviour in crosses with normal grains is being studied.

RICE 633.18

34. 633.18:575:061.6(54.8)

SHARMA, S. V.

Paddy Breeding Station, Nagenahalli.

J. Mysore Agric. Exp. Un. **15** : 21–30.

An account of the work of the central station for paddy breeding in Mysore State. In addition to trials of green manures and spacing tests, variety trials, selection and hybridization are performed.

Descriptions are given of five strains which have been evolved by selection. The aim of the hybridization work is to produce a strain with a good yield of grain and straw to replace G.E.B.24.

35. RAMIAH, K. 633.18:575.1:576.3
Rice genetics. Address by the retiring President.
Proc. Ass. Econ. Biol. Coimbatore 1935 : **3** : 51–61.
A general survey based on the author's long experience of the subject. The topics touched on include floral biology and natural crossing, factorial analysis, linkage groups and their identification with particular chromosomes by means of trisomics, cytology in relation to the possible polyploid nature of rice and to semi-sterile forms, and lastly mutations, natural and induced.
The carrying out of genetical research by the Universities of India is strongly urged and also the importance of a uniform system of genetical nomenclature among rice workers is recommended.

36. KADAM, B. S., PATIL, G. G. and PATANKAR, V. K. 633.18:581.46
Doubled awned spikelets in rice.
Curr. Sci. 1936 : **4** : p. 739.
An F_3 culture from a single, normal F_2 plant consisted of 29 plants bearing some double awned spikelets in the upper part of the panicle branch and 10 normal plants. Further generations are being grown to see whether the condition is inherited.

37. PARTHASARATHI, N. 633.18:581.46:575.11
The inheritance of multiple pistils in rice.
Proc. Ass. Econ. Biol. Coimbatore 1935 : **3** : 32–41.
The simple recessive character multiple pistils was found to be inherited independently of long sterile glumes, aggregation of spikelets, purple colour of the apiculus, anthocyanin pigmentation of fertile glumes, glutinous endosperm and pericarp colour. It shewed some association with grain size, which is determined by multiple factors and with sterility, also a quantitative character, determined by an unknown number of factors.
The taxonomic significance of the character is discussed.

ROOTS AND TUBERS 633.4

38. ELLISON, W. 633.491:575.127.2:576.356.7
Synapsis and sterility in a *Solanum* hybrid.
J. Genet. 1936 : **32** : 473–77.
In a hybrid from the cross *S. nigrum* (2n = 72) x *S. nitidibaccatum* (2n = 24) there were found 48 somatic chromosomes, forming as a rule 24 bivalents at meiosis, though from two to six univalents sometimes occurred. It is suggested that the mode of pairing was most probably twelve autosyndetic and twelve allosyndetic bivalents. The occurrence and nature of secondary association at meiosis in *S. nigrum* yielded further evidence of the affinity between different *nigrum* chromosomes indicated by the autosyndesis in the hybrid.
In spite of the regularity of pairing and the plentiful production of apparently normal pollen, the hybrid was self-sterile.

39. 633.491–2.411.4–1.541
BOND, T. E. T. 635.64–2.484–1.541
***Phytophthora infestans* (Mont.) de Bary and *Cladosporium fulvum* Cooke on varieties of tomato and potato and on grafted Solanaceous plants.**
Ann. Appl. Biol. 1936 : **23** : 11–29.
In a series of grafting experiments with varieties of potatoes, tomatoes and other *Solanaceae* it was found that the stock and scion each maintained their characteristic reaction to *P. infestans* and *C. fulvum* and were uninfluenced, as far as the results indicated, by each other.
This indicates that resistance and susceptibility are genotypic properties of the protoplasm or else are due to some factor not transmissible between stock and scion.

FIBRES 633.5

40. 633.51 39 Mollisoni
MOHAMMAD AFZAL, C. 633.51:575(54.5)
A new desi cotton—39 Mollisoni.
Seasonal Notes Punjab Agric. Dep. 1936 : **14** : 6–7.
The new variety, produced by the Punjab Botanical Research Scheme, has proved superior to 15 Mollisoni.

41. 633.51:575(54.7)

Improved varieties of cotton for Sind and their cultivation.

Agric. Leafl. Sind 1935 : No. 149 : Pp. 7.

Descriptions are given of new varieties bred by the Agricultural Department in Sind, the varieties mentioned being the Sind-American cottons Sind Sudhar and Sind-American 4F–98, the imported Egyptian and Sea Island cottons Sind Boss III and Sind Sea Island and the Sind Deshi cotton Sind N.R.

Notes are also given on their cultivation.

42. HUTCHINSON, J. B. 633.51:575.11.061.1

The genetics of cotton. Part XVI. Some observations on the inheritance of form and size in Asiatic cottons.

J. Genet. 1936 : **32** : 399–410.

The extended form of the paper reviewed in " Plant Breeding Abstracts," Vol. VI, Abst. 581.

43. HARLAND, S. C. 633.51:575.129:576.12

Cotton notes.

Trop. Agriculture, Trin. 1936 : **13** : p. 160.

A criticism of the article reviewed in " Plant Breeding Abstracts," Vol. VI, Abst. 936. Davie's suggestion that the New World cottons arose from a cross between a wild American diploid and *G. mexicanum* or *G. brasiliensis* is refuted on the grounds that these latter species are themselves closely related to *G. hirsutum* and *G. barbadense* respectively and are tetraploids. It is further pointed out that Asiatic cottons introduced in the sixteenth and seventeenth centuries would not be likely to continue in cultivation and that the hybridization assumed in Skovsted's and Harland's theory propably occurred in late Cretaceous or early Tertiary times.

Okra cotton is stated to be merely a form of *G. hirsutum* and not, as Davie said, an Asiatic form.

44. FIELDING, W. L. 633.51.00.15(68.2)

The organization of the native staff on an African experiment station. With some details of the way in which plant breeding and general experimental work is carried out at Barberton.

Emp. Cott. Gr. Rev. 1936 : **13** : 200–05.

Details are given of the routine work of variety trials and of the propagation of pure lines at the Cotton Experimental Station, Barberton.

SUGAR PLANTS 633.6

45. 633.61:001.4

633.61 Uba

DEERR, N.

The Uba cane.

Int. Sug. J. 1936 : **38** : 255–56.

In spite of the story of the damaged label bearing the letters U, B and A, the author maintains his opinion that Uba in Natal came from Brazil via Mauritius, supporting it with evidence that a shipment of cane from Mauritius reached Natal at the same time that one arrived from India. He finds moreover that Uba from Brazil is indistinguishable from Uba from Natal and from the canes known as Chinia, Pansahi, Merthi and Agaul.

46. 633.61:001.4(91.4)

633.61:575

633.61 Alunan

ROSENFELD, A. H.

Nomenclature and genetics of sugar cane seedlings.

Int. Sug. J. 1936 : **38** : p. 180.

A further note (Cf. " Plant Breeding Abstracts," Vol. VI, Absts. 362 and 721) in which the breeding of seedlings by the Philippine Bureau of Plant Industry at La Carlota is mentioned. One of the most popular varieties is LC25/191, renamed Alunan, a cross between Badila and Java 247 (B). LC denotes the place and 25 the year of breeding, 191 being the serial number. Other breeding work in the Philippines includes that by Victorias Milling Company, whose varieties bear the letters VMC.

47. McIntosh, A. E. S. 633.61:575(72.97)

Report on a second visit to Antigua April, 1935.

Bull. B.W.I. Sug. Cane Breed. Sta. 1935 : No. 7 : Pp. 13.

A description of the types of soil occurring in Antigua is given with indications of the breeding problems they raise.

Variety trials so far performed have not been sufficient in number to give positive evidence as to which are the best varieties for the different parts of Antigua, but have served to eliminate the less promising varieties. Descriptions are given of the more promising varieties and an account of the suggested variety trials for the season 1935 37 in which they are to be included. It is also suggested that select seedling trials should be performed in the same season.

In general it is considered that the majority of the Antigua sugar cane lands will be best served by noble cane seedlings and seedlings derived from the higher degrees of nobilization of wild species. For certain soils the ability to ratoon strongly is the chief desideratum.

48. 633.61:575(72.98)

Sugar cane breeding in the West Indies.

Int. Sug. J. 1936 : **38** : 125–28.

An extensive summary of the bulletin reviewed in " Plant Breeding Abstracts," Vol. VI, Abst. 368 and also a very brief summary of the annual report reviewed in " Plant Breeding Abstracts," Vol. VI, Abst. 726.

49. 633.61:575:578.08

Bell, A. F. 633.61:575(94.3)

The breeding of new varieties of sugar-cane.

Cane Gr. Quart. Bull. 1936 : **3** : 134–41.

The expansion of the work of the Bureau of Sugar Experiment Station, Brisbane is outlined with a sketch of earlier work on sugar cane breeding in Australia. Recently some first crosses between sugar cane and sorghum have been introduced and are to be back-crossed to sugar cane at Meringa, the new site to which the Northern Station has been moved in order to ensure a lower rainfall.

The general technique used in raising seedlings in Queensland is fully described.

50. 633.61:575.42:578.08

Symposium on methods of selecting seedlings.

Rep. 5th Congr., Int. Soc. Sug. Cane Techn., Brisbane 1935 : 324–56.

The symposium is composed of a series of papers describing the different methods adopted in the several countries in which sugar cane breeding is undertaken. The main value lies in the comparative means adopted to solve the main practical problem of selecting from the very large number of seedlings raised from seed. Of major interest also is the manner in which efforts are being made to correlate useful parental and seedling characters with the object of concentrating on those parents which prove to possess the capacity of handing on such characters to the greatest degree.

A. E. S. McIntosh. *Methods of selecting seedlings at the Sugar Cane Breeding Station in Barbados.* (*pp. 324–26*).

Since Barbados became the central breeding station for the West Indies, seedlings are required for a wide range of conditions. Parental ability is placed in the forefront and nobilizing of wild species has had to be adopted. The crosses from two groups, proven crosses from parents of recognized value and trial combinations of unproven value. Selection in the pot stage eliminates some 50 per cent of the seedlings. The basis on which subsequent selection is made is described.

R. L. Davis. *Methods of selecting seedlings.* (*pp. 326–27*).

Much of the breeding is from self-fertile varieties and it is held that the selfed seedlings can be readily identified in the flats owing to their slower growth, and eliminated. The various stages in later selection are described.

G. B. Sartoris. *Methods of selecting seedlings at the United States Sugar Plant Field Station, Canal Point, Florida.* (*pp. 328–33*).

Emphasis is here laid on the determination of parental ability and a number of instruments are described for determining such characters as erectness of stalks and leaves and solidness of stalk

(pith diameter). A ' growth rating ' is calculated from number of stalks per stool, diameter and length of stalk, habit and general health. Parental breeding value is determined on percentage of selected seedlings, number of seedlings selected, average percentage solids in juice, percentage solids x specific gravity x growth rating, mean value of the characters, height, diameter, stalk erect, solidness of stalk and growth rating x average percentage of seedlings in the higher classes of frequency tables of each character.

B. A. Bourne. — *Method of selecting cane seedlings in the Everglades as practised at the Florida Agricultural Experiment Station.* (*pp. 333–39*).

No selection is made in the early stages and selections are made at the end of each season, the bases of these selections being given.

A. G. Hill. — *A brief account of selection methods at present used in Mauritius.* (*pp. 339–41*).

Only healthy and well grown seedlings are taken to pots from the flats and a like selection made when planting in the field. The seedlings are distributed between the uplands (1,000 ft.) and the lowlands (200 ft.). Later selection methods are described.

H. F. Clarke. — *The methods of selecting seedlings practised by the Colonial Sugar Refining Company Ltd.* (*pp. 341–42*).

Fiji. Some 5 per cent of the seedlings are selected at 17 to 18 months and a second selection of the rows from cuttings of the selected seedlings at 15 to 20 months.

Queensland. The methods are similar, with the addition of tests in the second year in a gum resistance trial.

New South Wales. Seedlings are raised from fuzz and, at three to four months, planted directly in a gum resistance trial which is repeated in the second year. Selection is primarily based on gum resistance. Later selection after a further year is made on 12 months plants from cuttings plus the 24-month old original plants.

E. J. Barke. — *Methods of seedling selection in Queensland.* (*pp. 343–44*).

Selection is primarily for the purpose of disease control and at least 100 seedlings from all crosses yielding a reasonable standard of vigour are directly included in a ' family ' resistance trial for leaf scald and/or gum. The bases of later selections are detailed.

T. S. Venkatraman. — *Methods of selecting seedlings as adopted at Coimbatore.* (*pp. 344–48*).

The special problem of breeding for a locality, northern India, far removed from the station requires special methods which are described. Emphasis is laid on the determination of parental ability. Of particular interest are the large range of specific forms included and the very large numbers of seedlings raised which are filtered on the basis of easily noticeable vegetative and growth characters.

A. J. Mangelsdorf. — *Sugar-cane breeding in Hawaii.* (*pp. 348–56*).

The most interesting feature here is the weak solution of sulphur dioxide in which the cut cane stalk will ripen its seed. Both male and female tassels are cut and some four female and six male tasselling stalks of the required cross are set up in pails of the solution in a coconut grove remote from any cane field. A wide range of species is included and much attention is being given to *S. robustum*, introduced from New Guinea in 1930. The various stages in selection are detailed.

H.M.L.

51. Janaki Ammal, E. K. 633.61:576.312.35

Cytogenetic studies in *Saccharum spontaneum* L.

Proc. Ass. Econ. Biol. Coimbatore 1935 : **3** : p. 14.

A brief account of the work reviewed in " Plant Breeding Abstracts," Vol. VI, Absts. 1101 and 1102.

52. KING, N. J. 633.61–2.3–1.521.6:575
The Bundaberg Sugar Experiment Station.
Cane Gr. Quart. Bull. 1936 : **3** : 129–33.
The early history and work of the Station, founded in 1913, is described. In 1930 the raising of seedlings was begun, the arrows being obtained from South Johnstone Station, and now some 6,000 seedlings are grown annually. Seedlings are also tested for performance, including disease resistance, and some have reached the varietal trial stage. Irrigation and manuring investigations also form part of the activities of the Station.

53. 633.61–2.3–1.521.6:575(94.4)
H. M. L. 632.3:576.16:633.61
Gumming disease of sugar cane.
Int. Sug. J. 1936 : **38** : 164–67.
An extensive summary of the report reviewed in " Plant Breeding Abstracts " Vol. VI, Abst. 1104.

54. VERTEUIL, L. L. DE 633.61–2.7–1.521.6
Sugar-cane varieties in Antigua in relation to (*a*) infestation, (*b*) field losses by the moth borer (*Diatraea saccharalis* Fabr.).
Trop. Agriculture, Trin. 1936 : **13** : 130–35.
After a brief account of the injury and losses caused by the moth borer and a review of the literature on varietal differences in susceptibility, observations made on two variety trials subject to different degrees of infestation are given and analysed statistically. From the experiment in which the infestation was heavy, significant varietal differences were deduced in respect of both loss in weight and joint infestation. P.O.J. 2878 was much more susceptible than the other varieties grown. It was also found that percentage loss in weight is not necessarily proportionate to percentage joint infestation. When the infestation was light, varietal differences could not be detected.

STIMULANTS 633.7

55. 633.71:575(71)
Tobacco breeding in Canada.
The Lighter, Ottawa, 1936 : **6** (2) : p. 6.
Tobacco breeding is performed in Canada by the Tobacco Division of the Experimental Farms Branch. Most of the original crosses are made at the Central Experimental Farm, Ottawa, but the subsequent study of hybrids and selections is also carried out on different Branch Farms, each of which concentrates on one or two related types of tobacco.

56. KOSTOFF, D. 633.71:575.12:575.129
The origin of cultivated tobacco.
Curr. Sci. 1936 : **4** : p. 872.
It is suggested that *Nicotiana Tabacum* L. is an amphidiploid arising from the cross *N. sylvestris* x *N. tomentosiformis* (*N. Rusbyi*) the evidence being the resemblance between meiosis in F_1 hybrids between the latter species and that in haploid plants of *N. Tabacum* (24 univalents being the general rule in each case), the complete fertility of the triple hybrid *N. Tabacum* x (*N. sylvestris* x *N. tomentosiformis*) and the resemblance of the amphidiploid *sylvestris-tomentosiformis* to *N. Tabacum*.
Evidence of a similar nature is adduced to support the hypothesis that *N. rustica* L. represents an amphidiploid from the cross *N. paniculata* x *N. undulata*.

57. 633.71:575.42(75.7)
MANDELSON, L. F. 633.71 Gold Dollar
The tobacco-growing industry in the United States of America.
Qd Agric. J. 1936 : **45** : 461–83, 541–74.
In connexion with flue-cured varieties, the work of the Coker Seed Company in South Carolina in studying commercial varieties and making selections from them is mentioned. Gold Dollar is one of their selections, derived from Jamaica Wrapper.

58. 633.72:575.42

Tenth Annual Report of the Board of the Tea Research Institute of Ceylon for 1935.

Bull. Tea Res. Inst. Ceylon 1935 : No. 13 : Pp. 85.

Figures are given indicating the range in productivity of individual tea bushes and the importance of applying selection is emphasized.

59. 633.73:575.42(67.62)

Selection of coffee trees.

Mon. Bull. Coffee Bd. Kenya 1936 : **2** : p. 100. Col. 2.

With a view to carrying out selection work the Coffee Section of the Scott Agricultural Laboratories asks planters to report on any trees outstanding in yield or disease resistance.

60. Cheesman, E. E. 633.74:575(72.98)

The position of the botanical researches at the end of 1935.

5th Ann. Rep. Cacao Res. Trinidad 1936 : 3–4.

The five-year period of preliminary investigations has now been completed and the position of cacao botanical research in Trinidad is surveyed in this article.

The technique of propagating cacao vegetatively on its own roots has been developed and it is now possible to produce genetically uniform material in quantity for field experiments. The description of 100 trees on the Imperial College selection list has now been completed. Studies on fruitfulness have been taken as far as is possible with mixed seedling trees and further development must depend on the new clones when they begin to bear.

In the future, work will be directed towards studying the behaviour of sexually and vegatatively reproduced progenies of selected trees, an elaborate field experiment in which each of the 100 selections will be represented by 100 trees, and the formation of a representative collection of cacao types.

61. Cheesman, E. E. 633.74:575(72.98)

The present position of botanical researches on cacao.

Trop. Agriculture, Trin. 1936 : **13** : 123–29.

A review of the botanical and selection work on cacao at the Imperial College of Tropical Agriculture, Trinidad. Most of the work described has been reviewed from time to time in " Plant Breeding Abstracts ".

62. Pound, F. J. 633.74:575.42(72.98)

The completion of selection, 1935.

5th Ann. Rep. Cacao Res. Trinidad 1936 : 7–16.

Descriptions are given of sixty-four trees on the Imperial College selection list, bringing the total described up to one hundred and completing the list (see also " Plant Breeding Abstracts," Vol. VI, Abst. 385).

63. 633.79:575(42)

633.79 Fillpocket

Salmon, E. S. 633.79 Quality Hop

Two new varieties of hops : " Fillpocket " and " Quality Hop."

J. S.-E. Agric. Coll. Wye 1936 : No. 38 : 38–47.

Descriptions are given of the varieties Fillpocket and Quality Hop, which up to now have been known as Z62 and 0063 respectively. Fillpocket arose from a seed of M 45, itself a seedling from the American variety Oregon Cluster. Quality Hop is a seedling from Op 13, which had the same origin as Fillpocket. The male parents are all unknown. The botanical characters, susceptibility to diseases and chemical characteristics of the varieties are described. Of the two Fillpocket is the heavier yielder while Quality Hop is the richer, though they are both high in preservative value.

64. Babu, C. N. 633.812:576.313.35

Chromosome numbers in *Cymbopogon* species.

Curr. Sci. 1936 : **4** : 793–40, 874–75.

In the two letters the following somatic chromosome numbers are recorded : *C. polyneurus*, Stapf, 20 ; *C. Caesius*, Stapf, 22 ; *C. fle-uosus*, Wats., (variety from Kallar). 20 ; *C. Nardus*, Temdle, 20 ; C. *Martini*, Wats., 40 ; *C. coloratus*, Stapf, 40 and *C. citratus*, Stapf, 60. (Cf. Abst. 64).

RUBBER PLANTS 633.9

65. 633.912:575(54.8)
633.912:678.1

Report of the work of the Rubber Research Board in 1934.

Rubb. Res. Scheme, Ceylon, March 1935 : Pp. 79.

Artificial cross-pollination of Ceylon clones at Nivitigalakele was carried out during the flowering season, February to early April, but was greatly hindered by infection by *Oidium*, which causes the young flowers to shrivel and drop without opening. To a certain extent this can be overcome by sulphur dusting. Of 1,341 polllinations there were 44 successes and ultimately 13 seedlings were obtained.

The testing of Ceylon and imported clones has been continued. Tjirandji I appears to be the quickest growing of the imported clones. Only five new clones from high yielding mother trees were introduced into the Nivitigalakele budwood multiplication nursery, which now contains material of nearly 200 untested Ceylon clones. About 80 of the most promising of these are to be established in 1935 in a portion of the 100-acre block of Pinnagoda land recently allocated to the Scheme.

A comparison of the growth rates of seedlings obtained from seeds differing in size and speed of germination indicated an advantage in favour of large and quickly germinating seed, but the result was not statistically significant.

Tests at the Imperial Institute, South Kensington have indicated that different Ceylon clones differ in the quality of the rubber they produce, but it is not known to what extent the differences are hereditary.

FRUIT TREES 634

66. Potter, T. I. 634:575(72.98)

The need for the improvement of some of our fruit.

Proc. Agric. Soc. Trin. Tob. 1936 : **36** : 209–17.

The fruits mentioned and the improvements suggested are as follows :—Sweet orange (*Citrus aurantium*)—seedlessness in an established type ; West Indian lime—spinelessness and seddlessness combined with good quality ; mango—reducing the seed and increasing the size of the fruit of the variety Apricot or Zabricot, without affecting the flavour ; sapodilla (*Achras Sapota*)—seedlessness, absence of the white chalky exudation found around the inner stem in certain varieties and freedom from fruit fly attack ; Portugal, Tangerine and Mandarin oranges (*Citrus nobilis*)—seedlessness ; sugar apple and soursop (*Anona squamosa* and *A. muricata*)—reduction in the number of seeds, which might be achieved by crossing with the custard apple (*A reticulata*) or with a certain wild variety ; the papaw (*Carica papaya*)—improvement by crosses with superior types from the north of South America ; pomerac (*Eugenia malaccensis*)– seedlessness, a seedless variety being known in Venezuela ; Jamaica plum and yellow plum (*Spondias purpurea*)—elimination or reduction in size of the seed ; guava (*Psidium guava*)—seedlessness and immunity from fruit fly attack. In the case of the Hog-plum (*Spondias lutea*) and golden apple or Otaheite apple (*S. dulcis*)—the former having a smooth round seed, but scanty and rather acid pulp, while the latter is larger, with delicious pulp but a spiny seed—it is suggested that a cross might combine the better features of each, though the cross would not be easily made.

It is also suggested that the pineapple and the plum rose or pomme rose (*Eugenia jambos*) could be improved.

67. NEBEL, B. R. 634.11:575.183
Metaxenia in apples. V.
J. Pomol. 1936 : **14** : 203–04.

In one set of tests it was found that pollination of McIntosh by Red Astrachan gave more acid fruits than pollination by Yellow Bellflower, and, in another set, than pollination by *Malus baccata*. In a further experiment McIntosh was pollinated by Wilson Red June and Boiken. The resulting apples were similar in all respects except the percentage of apples rotted during storage, which was 47.6 in the Boiken cross and 0 in the Wilson Red June cross.

68. CRANE, M. B., GREENSLADE, R. M., 634.11–2.7–1.521.6
MASSEE, A. M. and TYDEMAN, H. M. 634.11–1.541.11:575
Studies on the resistance and immunity of apples to the woolly aphis, *Eriosoma lanigerum* (Hausm.).
J. Pomol. 1936 : **14** : 137-63.

A survey of the work at the John Innes Horticultural Institution and at the East Malling Research Station.

The life cycle of the aphis is described. Root infestation is of importance in that it provides a reserve of insects that cannot be controlled and which may re-infect the tops of the trees, hence the need for resistant rootstocks. Northern Spy is quite immune but possesses certain defects as a rootstock. Efforts were therefore directed towards the breeding of immune rootstocks which would be satisfactory from other points of view.

All the varieties and rootstocks used extensively in breeding are diploids. The immune types include Northern Spy and a number of other varieties while the susceptible ones comprise certain of the Malling " Paradise " rootstocks and some commercial varieties. The method of testing has been developed during the investigation and at present all seedlings are tested in a special greenhouse in their first year, susceptible seedlings being discarded forthwith. Since 1932 no attempt has been made to distinguish different degrees of susceptibility.

Though there may be some relationship between the amount of sclerenchyma in the stem and the degree of resistance, it appears that resistance cannot be explained solely on mechanical grounds. There is evidence that resistant types carry a substance, possibly a pectin or a hemi-cellulose, which hinders reproduction of the aphides.

The breeding results are very complex and no scheme of inheritance is postulated to explain them. Certain general conclusions are however indicated. Susceptible types are genetically of different kinds ; some possess factors or genes, concerned with the determination of immunity and some do not. Of the former types some play a larger part in the transmission of immunity than others and there is a graduation in the inheritance of susceptibility. All the immunes used are heterozygous and, like the susceptibles, are of different kinds ; Northern Spy has been the best in respect of the transmission of immunity. Immunes selfed give some susceptibles and vice versa. In some cases reciprocal crosses give similar and in others dissimilar results. Collectively the results indicate that the hereditary behaviour of immunity is dependent on a certain balance of genetic factors, the action of the genes controlling it being in part complementary and in part cumulative. Further results are needed, in particular from inbreeding immunes and susceptibles. Since it has been shewn that immunes may arise from crosses between susceptibles, such crosses are to be made more extensively and the results may assist in the genetical interpretation.

In all, 573 immune seedlings have been produced and many are undergoing trial to ascertain the ease with which they can be propagated vegetatively and the influence they exert as rootstocks over the scion variety with which they are worked. Observations on both these points have as yet only been obtained on three seedlings, known as Merton Nos. 778, 789 and 793 and raised at Merton in 1920 from a family of Malling No. II x Northern Spy. Details of the behaviour of these seedlings when budded with Lane's Prince Albert are given.

69. 634.3:575.252(68)

Mazoe Citrus Experimental Station. Annual Report for 1934. I. Report on the work of the Mazoe Citrus Experimental Station for the year ending December 31st, 1934.

Publ. Brit. S. Africa Co. 1936 : No. 4 : vii–xvi.

Buds have been taken immediately behind fruits exhibiting different types of malformation, in connexion with an investigation into the transmission of undesirable characters by budding.

70. Tanaka, T. 634.3:576.16:575

Origin and development of Citrus species and varieties.

Proc. Ass. Econ. Biol. Coimbatore 1935 : **3** : 49–50.

After a brief discussion of the taxonomy of the group the scheme of classification advocated by the author is outlined.

The study of the original home of the citrus, North East India, is recommended as likely to produce forms of value for breeding.

71. Wright, N. 634.3:581.163

On the seedlessness of Citrus fruits with particular reference to marsh grapefruit.

Trop. Agriculture, Trin. 1936 : **13** : 118–22.

From a survey of the literature the conclusion is reached that cross-pollination and bud mutation are the two chief causes of seed production in so-called seedless Citrus fruits.

The methods to be adopted by growers in checking seediness are indicated and also the lines of investigation of the problem.

72. Fahey, H. 634.323:581.163

The problem of the occurrence of seeded fruit in the grape fruit orchards of Trinidad.

Proc. Agric. Soc. Trin. Tob. 1936 : **36** : 113–15.

It is suggested that though cross-pollination and bud mutation play some part in the production of seeds in so-called seedless grapefruits, a much more important factor is the planting of seeded varieties in mistake for seedless ones.

NUTS 634.5

73. 634.58 *Gigantea*

John, C. M. and Seshadri, C. R. 634.58:575.12(54.8)

A new groundnut *Arachis hypogaea*, Linn. var. *Gigantea* Patel et Narayana (var. *Nova*).

Curr. Sci. 1936 : **4** : 737–38.

A description is given of the new variety which is derived from the cross between A.H.32 Gudiyattam bunch and the spreading variety A.H.17 Madagascar. It differs markedly from other forms of groundnuts in that its trailing primary and secondary branches attain a length of 5′ and the axis of the inflorescence instead of being very short reaches a length of 4 to 8 inches. It crosses freely with other varieties of *Arachis hypogea*.

FORESTRY 634.9

74. 634.9(038)

A glossary of technical terms for use in Indian forestry. (Adopted for official use by the Silvicultural Conference, Dehra Dun, March, 1929, and revised in 1935.)

Indian For. Rec. 1936 : **2** : N.S. (Silviculture) : Pp. v + 45.

The glossary is based on an earlier one compiled in 1908 by A. M. F. Caccia and revised in 1911 by R. S. Troup. Recommendations made at different Forestry Conferences have been incorporated and the number of cross-references has been reduced.

There are three appendices, dealing with the classification of sylvicultural systems, tree classification into crown classes and classification of thinnings, and the English equivalents of forestry terms used in the U.S.A.

75. 635.652–2.3–1.521.6:575.41

PUGSLEY, A. T. 635.652 Burnley Selection

Halo blight of beans. Varietal resistance tests.

J. Dep. Agric. Vict. 1936 : **34** : 311–15.

Reference is made to the origin by natural selection of a strain resistant to halo blight, *Phytomonas medicaginis* var. *phaseolicola* Burk. The strain which is referred to here as Burnley Selection, arose from the susceptible variety Canadian Wonder, from which it also differs in certain morphological characters.

76.

RANGASWAMI AYYANGAR, G. N. and KRISHNASWAMY, N. 635.654:576.312.35

Chromosome numbers in *Dolichos lablab* (Linn.) and (Roxb.).

Curr. Sci. 1936 : **4** : p. 739.

In a variety of field and garden forms the chromosome numbers n = 12 and 2n = 24 were recorded. In F_1 hybrids between field and garden varieties chromosome separation at meiosis appeared to be regular.

Part II. Foreign

STATISTICS 519

77. Wellensiek, S. J. 519.2:575
Causality and chance.
Hand. 7de Ned.-Ind. Natuurw. Congr. 1936 : 527–33.
Examples from physiology, pathology and genetics are quoted to illustrate the principle that when a process is conditioned by several factors, of which some are unknown or uncontrolled, chance as well as causality plays a part in the determination of the process.

78. Reichel, H. 519.24
Über eine verbesserte Methode der Berechnung der Abhängigkeit von Merkmalen (Vierfelderrechnung). [**An improved method of calculating the correlation between characters (four-fold table).**]
Genetica 1936 : **18** : 146–56.
The purpose of this paper is to present a method of calculation of the correlation coefficient between two characters exhibited in a four-fold table, and its standard error. A value of r is reached which is the same as $\sqrt{(\chi^2/n)}$ of the English notation in tests of independence, while its standard error is given as $\sqrt{\{(1-r^2)/2(n-2)\}}$, n being the total number of cases. The test is illustrated.
J.W.

79. Wang, C. M., Chen, L. T. and Yang, C. C. 519.24
(Some results of field experiments in rice for comparison of the moving average method and the variance method).
J. Agric. Ass. China 1936 : No. 145 : 1–25.
The moving average method developed by Richey is criticized on mathematical grounds. When it was compared with Fisher's analysis of variance in treating the results of a test of five varieties with five replications, the standard error of a single determination was less when derived by the analysis of variance : this was the case both when the plots were arranged systematically within the blocks and when they were arranged at random.

80. Neyman, J. and Tokarska, B. 519.24:631.557
Errors of the second kind in testing " Student's " hypothesis.
J. Amer. Statist. Ass. 1936 : **31** : 318–26.
The purpose of this paper is to present certain tables, the most complete of their kind so far published, whose use is illustrated in the following example. Let a new variety V_1 be tested in a replicated experiment in comparison with an established standard V_0. The breeder tests the hypothesis that the yield of the new variety is not greater than that of the old, and choosing a level of significance, e.g. 0·01, he reduces the probability of his unjust rejection of the hypothesis tested to a level not exceeding 0·01. But he will now be interested in the size of differences between tested the yields of V_0 and V_1, which he is likely to detect in his experiment in case they in fact exist. The new variety may be better than the standard, but owing to random variation its advantage may remain undetected. Given the standard error of the data and the number of degrees of freedom on which the estimate of error is based, he may enter the new tables and find, e.g. that if the true excess in yield of V_1 over V_0 is as large as 12 per cent, the experiment that has been carried out will fail to detect this difference in 10 per cent of cases. In this way the experimenter can judge the efficacy of the trial. If he is not satisfied he may increase the number of replications, use a less stringent level of significance, such as 0·05 instead of 0·01, or lower the standard error by improving the experimental technique.
The tables are for the levels of significance 0·05 and 0·01, for n (degrees of freedom) going from 1 to 30 and infinity, and for chance of non-detection running from 0·01 to 0·90. J. W.

81. Oehlkers, F. 575
Vererbung. (**Inheritance**).
Fortschr. Bot., Berl. 1936 : **5** : 290–313.
The annual survey of the literature of genetical research for 1935 includes reviews of the problems of dominance in the F_1, genom analysis and the effect of chromosome addition and loss on the genotype, plasmatic inheritance, mutation and evolution and the more specialized work on the genetics of individual characters.

82. Akemine, M. 575:633:016
General reference books and periodicals on genetics and plant breeding.
J. Sapporo Soc. Agric. For. 1936 : **27** : 521–34.
Akemine, M.
Special reference books on plant genetics and plant breeding.
J. Sapporo Soc. Agric. For. 1936 : **28** : 81–90.
These two articles will supply the Japanese reader with a useful list of books and periodicals on genetics and plant breeding, compiled from English, German, French, Italian, Dutch, Swedish, Russian and Japanese literature.
The number of references on the general aspects of the subject is 290 and on the specialized aspects (including works on particular plants) is 175. The references comprise literature from very early sources as well as that of the present day (1935).
Both bibliographies, the second in particular, have been conveniently grouped as far as possible under subjects.

83. Nilsson-Ehle, H. 575:633(4)
Züchtungsforschung im Dienste der Landwirtschaft. (**Plant breeding research in the service of agriculture**).
Naturwissenschaften 1935 : **23** : 265–77.
An account of a lecture on agricultural plant breeding with special reference to principles and methods, and future prospects as regards the crop plants of Northern Europe. Many examples are drawn from the achievements of Swedish breeders, e.g. in the production by hybridization of high yield combined with winter-hardiness, or of high yield combined with early maturity in cereals. Transgressive characters, direct selection from populations, dependence of heritable characters upon environment, polyploidy and mutations are among the aspects treated. In his concluding remarks the author, in opposition to both Lamarck and Darwin, states his belief that rare, progressive mutations, new combinations and chromosomal changes are the real factors of evolution.

84. 575:633(43.7)
631.521.5(43.7)
Freudl, E. 633.0014(43.7)
Die Pflanzenzüchtung in der tschechoslovakischen Republik. (**Plant breeding in the Czecho-slovakian Republic**).
Wien. landw. Ztg. Sonderheft : Tschechoslovakei 1935 : 20–21.
Plant breeding was begun at an early period and was based primarily on the use of the indigenous varieties. At the present time there are in the whole country 63 centres engaged in plant breeding; of these 3 are college institutes, 10 are experiment stations maintained by the State or provincial authorities and 50 are private concerns. Cereals, potatoes, beets and legumes mainly are bred. In addition to winter and spring wheat, high quality alternative wheat is of some importance. The breeding of barley is particularly advanced. Rye and oat breeding are in the main based upon foreign varieties. In the breeding of sugar beet and potatoes there are many years of successful activity to look back upon. Intimately related to breeding work are certification of seed and testing of varieties, both of which are regulated by law, a fact which has proved to the advantage of agriculture.
A. B.

85. 575:633(47)

ALDANOV, A. D. 633.11:575.127

(25 years work of Saratov Central Station of plant-breeding and genetics).

Socialistic Grain Farming, Saratov, 1936 : **6** (2) : 131–42.

Among the achievements of the station in wheat breeding one of the most outstanding referred to is the production of the spring wheat *Lutescens* 062 by individual plant selection. This variety has yielded an average of 14.3 c. per ha. over a period of nineteen years and on account of its drought resistance has outyielded the local " Poltavka " in the seven worst drought years by 34.2 per cent. Various other varieties both of *T. vulgare* and *T. durum* have been produced by the same method, e.g. *Erythrospermum* 0341 and *T. durum hordeiforme* 0432.

By interspecific crossing the famous varieties Sarrubra and Sarrosa have been obtained from crosses of *T. vulgare* (Poltavka) and *T. durum* (Beloturka). These varieties are distinguished by their high drought resistance ; in yield they have surpassed the two parents by 25.4 and 32.1 per cent respectively and are more or less equal to *Lutescens* 062, which they distinctly excel in milling and baking quality. Sarrubra is free from shedding when standing in the field and is suitable for combine harvesting ; the area under this variety is constantly increasing. Other promising hybrids have been produced from later crosses of the same combination of species. Among these is an awnless *T. durum* equal to the standards in yield and earlier in maturity. Promising results have also been obtained from interracial crosses in *T. vulgare* and certain varieties resistant to smut and leaf rust have been produced.

In winter wheat equally successful results have been obtained. The variety *Lutescens* 0329 is characterized by exceptional cold resistance, and is closely followed by *Lutescens* 1060/10 ; these two varieties have made possible a considerable extension of wheat cultivation in the lower Volga basin. Various newer hybrids are equally, if not more, promising.

Many of the hybrids with rye are highly promising in respect of cold and drought resistance, yield and grain quality. The main characteristics of the forms that have proved most popular in cultivation are described. Some of them are equal to rye in earliness of maturity and exceed the standard wheat varieties in yield. They are being further crossed among themselves and with winter wheat and the amphidiploids obtained are also being used in crossing. Perennial rye is also being crossed with winter wheats in the attempt to produce perennial wheats. The same object is pursued in the crosses between *Agropyrum* and wheat. Some of these hybrids are at the same time possessed of great winter-hardiness and resistance both to drought and to many fungous diseases, and are also tolerant of very unfavourable growth conditions. The hybrids of *A. elongatum* contain the highest proportion of perennial plants in the later generations. Valuable hardy lines of both annual and perennial type have been isolated and some of these are now in the stage of variety testing.

Sunflowers resistant to *Orobanche* and also to moth and drought have been produced by selection. A valuable new form, No. 169, possesses in addition to these characters, high yielding ability and ripens in 95–104 days, giving also a satisfactory oil content. An early variety ripening in 78 days, also resistant to *Orobanche* and moth has been selected, and various interesting lines have been obtained by inbreeding. One of these, No. 137 is superior both in yield and oil content and is at the same time rust-resistant. Sunflower crosses have been made, including one between the variety No. 169 and the perennial wild species *Helianthus divaricatus* ; the hybrids are resistant to drought, rust and other fungous diseases, and include a perennial oil form which is receiving attention.

Improved strains of rye have been selected and constant lines have been obtained by inbreeding which exceed the standard in yield by 6 to 60 per cent. Crosses have been effected also between rye and *Agropyrum Cristatum.*

Millet has been subjected to selection and improved lines produced, including one No. 853, which is drought-resistant, uniform in ripening, free from shedding, good in grain quality, and unusually high in yield.

86. 575:633(47)
ALEKSANDROV, A. B. 63.00.15(47)
(Main problems of agricultural work in the Institute of Plant Industry).
Bull. Appl. Bot. Leningrad 1936 : Ser. A (18) : 5–16.

An outline is given of the main problems now facing Soviet plant breeders. In wheat the production of a rust-resistant substitute for Ukrainka, and of varieties with greater cold resistance and early maturity for the north, are the main problems. Interspecific hybridizational is so an important field of investigation and a new constant hybrid has been obtained in the fifth generation between *Aegilops* and *Triticum durum* which is valuable on account of its freedom from lodging and shedding. Many forms which in themselves, are found to produce extremely valuable forms on crossing, as in the case of the Afghan races of cereals. Much work is being devoted to vernalization and allied problems.

Work with the alkaloid-free lupins is now progressing along the lines of raising the protein and oil content, one line with as much as 48 per cent of protein having already been selected.

New improved lines of potatoes have already been obtained from crosses of the domestic potato with the wild and cultivated potato species of South America.

In fruit culture the main problems are the enlargement of the stock by collecting expeditions, so as to have the best possible material for breeding and to be in a position to produce improved types and forms with an extended bearing season. Since the discovery of the hybrid nature of the domestic plum by Rybin (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 1363) great attention has been given to interspecific crossing in fruit trees.

Among the other main lines of investigation mentioned are the bio-chemical and physiological aspects of breeding improved lines, the study of the nature of heterosis, of sterility between species and the development of the method of inbreeding.

87. 575:633:061.6(49.5)
633.1:575(49.5)
(The Salonica Plant-Breeding Institute, 1923–1933).
Bull. Pl.-Breed. Inst. Salonica 1933 : No. 15 : Pp. 35.

The main contents of this Bulletin have already been reviewed (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 821).

88. *VALLE, O. 575:633:551.566.3(47)
Venäläiseen kasvinjalostustyöhön tutustumassa varsinkin Hiipinän Subarktisella Kasvinviljelyskoeasemalla. **(Visit to Russia to inspect plant breeding work in particular that carried out at the Khibiny Sub-Arctic Plant Cultivation Experimental Station).**
Maataloust. Aikakausk. 1935 : **7** : 135–48.

An account of a visit to Russia to inspect Institutions connected with research on plant breeding and cultivation in the U.S.S.R.

The institute at Detskoe Selo deals with problems of plant breeding, genetics and physiology, including the breeding of rye, potatoes and alkaloid-free lupins. Work on polyploid forms has proved of practical importance as, for example, in the production of tetraploid cabbage in which the doubling of the chromosome number has been accompanied by increased productivity. In the improvement of root crops species crosses are being used, while from crosses of remotely related forms of barley (e.g. Japanese x Abyssinian barley) it is hoped that new cultivated forms may be evolved.

Vernalization was the main problem of the physiological department and experiments are in progress with vernalized spring cereals and other crops. The value of the vernalization work in progress with various crops is estimated with certain reservations. Vernalization of cereals would not, it is believed, be of practical value under Finnish conditions but its application to legumes, mangels and lettuce and its value as a method of obtaining seed are mentioned.

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* A translation of this paper is on file at the Bureau.

Research is in progress with rye, the main object being to obtain self-fertile lines, with potatoes to obtain frost-resistant types, and finally with sweet lupins, which may become an important plant in Finnish agriculture.
The work at two other stations near Leningrad is also described with special mention of the successful breeding work with cereals and potatoes (including disease-resistant forms) and other crops.
The organization and scope of the work of the Khibiny experiment station established to investigate the prospects of plant production within the Arctic circle is described at some length and includes investigations on breeding, vernalization, cultivation and variety tests. Fodder crops (including oats), various roots, herbage plants and green vegetables are regarded as important crops for research. Experiments are also being made with small plants while potato breeding holds a foremost place in the programme of the station, favoured as it apparently is by the absence of the diseases such as are prevalent around Leningrad. Much of the work already accomplished with potatoes has been referred to from time to time in papers reviewed in " Plant Breeding Abstracts ". The report also deals with the breeding of spring cereals, including barley and oats, the research on herbage plants and vegetables and on short and long day plants (including the potato), on vernalization and cultural problems.
A full account of the activities of the Industrial State Farm and observations on the possible stimulus of the Russian pioneer work upon the development of agricultural research in Finland conclude the report.

89. SAPEHIN, L. A. 575:633:575.12
(Breeding at Bolshevist speed).
Bull. Appl. Bot. Leningrad 1936 : Ser. A (17) : 121–22.
The author points out the advantages of the method of repeated back-crossing in introducing one or two improvements into an otherwise desirable variety. In applying the method it is nesessary to know the number of genes in which the parents differ, the pleiotropic action, if any, of the genes and the combined effect of the genes united, which may be different from their effect in isolation. A factor of great importance is to be able to grow 3–4 generations in a year, as may be done with some crops, in which case it is possible to produce a new variety in 2–3 years.

90. S. N. 575:633:58.007
Pirmojo Lietuvos selekcininko 70 m. amžiaus sukaktuviu sulaukus. (**The 70th anniversary of the First Lithuanian Plant-Breeder**).
Žemės Ūkio Akad. Metraštis 1936 : **10** : 3–12.
A brief account of the life of Professor Rudzinskis who, having studied plant breeding in Russia, returned to Lithuania to organize the plant breeding station at Dotuura, where work on seed selection and improvement is being carried on with special reference to cereals, potatoes and flax.

91. 575:634
SCHULTZ, H. 575:635
Die Züchtung neuer Sorten im Gartenbau. (**Breeding new varieties in horticulture**).
Umschau 1936 : **40** : 229–36.
The main principles of plant breeding are outlined with special reference to horticultural plants and ornamentals, and to a number of special problems and achievements connected with these plants.

92. ALDERMAN, W. H. 575:634(73)
Accomplishments in fruit breeding by State and Federal Experiment Stations.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 13–20.
A list is given of 45 institutions concerned with fruit breeding in the U.S.A., Hawaii and Puerto Rico, based on replies to a questionnaire. The date when breeding began, the fruits concerned and the varieties introduced, if any, are given.

93. 575:635
Resolutions adopted by the XI International Horticultural Congress.—Rome, 16–21 September, 1935.
Int. Rev. Agric. 1935 : **26** : T 516–23.
The need for some legal protection of new varieties such as is in force in the U.S.A. is urged.

94. Roa Uriarte, E. 575.1
Johann Gregor Mendel y sus leyes de herencia. (**Johann Gregor Mendel and his laws of inheritance**).
Rev. Agric. Habana 1936 : **19** : 102–06.
A brief outline is given of Mendel's experiments and the laws he formulated.

95. Tschermak-Seysenegg, E. 575.1:575:633
Die Verwertung der modernen Vererbungsgesetze für die praktische Pflanzenzüchtung. (**The utilization of modern genetic principles in practical plant breeding**).
Wien. landw. Ztg. 1935 : **85** : 49–50.
With the beginning of the 20th century, important discoveries, connected with the names of Gregor Mendel, De Vries and Johannsen, were made in the field of genetics. Among these discoveries are included theoretical ideas to distinguish between phenotype and genotype, the cause of the occurrence of heritable changes within pure lines, loss mutations, the principles relating to transgression, reversion, heterosis, breeding for immunity and the effects of chromosome addition. In conclusion the author mentions his successes in breeding marrows with no tendrils and with naked seeds, stringless beans, a two-rowed early maturing winter barley for brewing purposes, and a high quality summer wheat, etc. A. B.

96. Brožek, A. 575.11
A simple method of mechanically developing Mendelian empiric frequency-ratios with and without linkage.
Věst. Král. Čes. Spol. Nauk. Tř. II. Roč. 1935 : Pp. 6.
Stud. Pl. Physiol. Lab. Charles Univ. 1935 : **5**.
A method is described of demonstating the production of dihybrid ratios by the simultaneous drawing of lettered discs from two urns into which they have been put in proportions corresponding to the expected gametic frequencies. The statistical analysis of the results is also illustrated.

97. Serebrovsky, A. S. 575.114
An attempt at a new method of genetical analysis of quantitative characters.
C. R. (Doklady) Acad. Sci. U.R.S.S. 1936 : **2** : 49–51.
The distribution of characters in a number of sibs from a cross varies in relation to the number of genes participating in the segregation, their strength, degree of dominance, linkage, etc. The distribution for various hypothetical cases can be calculated according to formulae given, and can be represented in the form of triangles or solid bodies, with which any experimental distribution can be compared.

98. Toselo, A. and Graner, E. A. 575.114
Questões que podem surgir no cruzamento de dois individuos hybridos para um par de factores. (**Questions that can arise in the cross of two individuals heterozygous for one pair of factors**).
Rev. Agric., S. Paulo 1936 : **11** : 133–37.
The number of different families of four individuals it is possible to get from a cross *Dd* x *Dd* is calculated and then the authors calculate the probabilities of getting a family of the composition 1 *DD* : 2 *Dd* : 1*dd* and of the composition 2 *DD* : 2 *dd*.

99. WEINSTEIN, A. 575.116.12
The theory of multiple-strand crossing-over.
Genetics 1936 : **21** : 155–99.
From mathematical considerations based on results in *Drosophila*, it is shewn that at any level crossing-over occurs between two of the four chromatids and that it is a matter of chance which chromatids cross over at any level, but there is no crossing-over between sister chromatids.

100. EAST, E. M. 575.123
Heterosis.
Genetics 1936 : **21** : 375–97.
Ashby's theory of heterosis in maize (Cf. " Plant Breeding Abstracts " Vol. I, Abst. 12 and Vol. III, Abst. 148) is reviewed and shewn to be inconsistent with genetical practice and theory. Jones' theory of linked dominant genes at different loci in the two parents is considered to be more likely and is supported with evidence from polyploid forms. Evidence is brought forward to support the author's contention that it is the non-defective type of genes (Cf. " Plant Breeding Abstracts " Vol. VI, Absts. 446 and 604) which are concerned in heterosis. A theory is propounded that when two unlike, non-defective allelomorphs come together the combined effect is less than the sum of their separate effects by an amount which decreases as their dissimilarity increases.

101. 575.127:615.37
KOSTOFF, D. 633.11:575.127.2:575.12
On the mutual reactions between plant extracts and heteroplastic graft components and their immunological and genetic significance.
Bull. Acad. Sci. U.R.S.S. Sci. Math. et Nat. 1935 : No. 8/9 : 1177–1216.
The author reviews his earlier work on the preciptin reactions of grafts and crosses between related species in the light of a number of criticisms from other workers and a certain amount of further experimental data.
The difference in grain size in reciprocal crosses between wheat species is shewn to be not entirely dependent on the chromosome numbers, since similar differences have been observed in crosses with *T. Timopheevi* with *T. persicum*, other species and hybrids having the same chromosome number as *T. Timopheevi*. These differences, and also other similar differences in hybrids and such phenomena as the increased mutation rate observed in hybrids, are thought to have a biochemical explanation in the interractions between the components from the two parents.

102. 575.183
TIKHONOV, P. M. 635.656:575.12:575.183
(Xenia in genetical investigations and in practical breeding).
Izvestija Agronomičeskogo Fakul'teta Saratovskogo Universiteta (Rep. Agric. Fac. Saratov. Univ.) 1935 : 30–41.
A cross was made between a sugary, transparent skinned, green pea and a starchy, pigmented skinned yellow type. In F_2, 3 : 1 segregation occurred for the first two characters and the dihybrid ratios for both of them taken together conformed to 9 : 3 : 3 : 1. The yellow : green combination also gave 3 : 1 ratios in the heterozygous plants but when all three characters were considered together, a deviation from the trihybrid ratio was obtained. The seeds actually represent the third generation and in consequence display F_3, not F_2 ratios. Hence the ratio of 5 yellow : 3 green would be expected and the observed ratio of 1,528 : 929 conform to this. The phenomenon is therefore an example of xenia. Other examples of xenia in a variety of plants are quoted.
Xenia can be of practical use in breeding in cases where it enables the double recessives to be separated from the dominants in the seeds of the F_1 plant without waiting for the F_2; in cases when the character shewing xenia is either desirable or undesirable from a breeding point of view time can therefore be saved and the bulk of material also reduced. In the case of monocotyledons, on account of double fertilization, xenia can be of particular importance in connexion with factors influencing the grain quality, as in the case of vitamin A content in maize (Cf. " Plant Breeding Abstracts " Vol. I, Abst. 523). The author suggests that, since it has been found possible to obtain

new plants by regeneration from a cotyledon of dicotyledonous seedlings, and any dividing cell is now thought capable of regeneration under certain conditions, it ought to be possible also to effect regeneration in the monocotyledonous endosperm and so produce a new source of variation for the purpose of breeding.

103. Bauer, E. and Borsdyko, S. 575.24
Mutations and the structure of living matter.
Biodynamica 1936 : No. 14 : Pp. 8.

It was found that aged seeds of *Crepis tectorum*, such as shew a high proportion of mutations (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 445) produced less " traumatic ammonia " than seeds which had not been aged. This, taken with other evidence as to the ability of ammonia to produce abnormal mitosis and increased mutation rates, suggests that there is a uniform mechanism of mutation the explanation of which is to be sought in the sensitivity of the chromosome apparatus to the traumatic ammonia which is produced in every injury to the living substance. The results also support Bauer's theory that mutations arise from processes which surpass the limits of physiological adaptation of the organism and thereby are a source of injury to the protoplasm.

104. 575.243:537.5:635.656
Krajevoj, B. J. 635.656:576.356.5
The influence of ultra-short rays on the chromosomes of plants.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1936 : **2** : 149–53.

By the analogy with the results of certain earlier investigators who produced mutants by means of long electro-magnetic waves, experiments were made with ultra-short electrical waves (4m.) on sprouting pea seedlings for 3, 10 and 15 minutes. The resulting root-tips displaced various chromosomal anomalies including lagging at anaphase, formation of micronuclei, fragmentation, translocation, " somatic reduction " and pseudomeiotic division of the somatic cells. In the case of " somatic reduction " the chromosomes were arranged in pairs, of which there were always seven, and which always consisted of identical partners. The further fate of the chromosomes could not be traced and actual reduction was not observed. Certain cases which externally resembled the second reduction division were observed, where two divisions had ensued without wall formation, giving rise to tetrads within a single cell, which evidently therefore contained 56 chromosomes.

The phenomena described as somatic reduction and pseudo meiosis have not been observed in X-ray material and thus represent an effect peculiar to the short-wave treatment, which would thus seem to afford a promising new source of mutations.

105. Khlop, M. L. 575.243:537.531
(**The problems of experimental production of mutations in plants under the influence of X-rays.**)
Bull. Appl. Bot. Leningrad 1936 : Ser. A (18) : 149–59.

The results of investigators on the problem outside the Soviet Union are first of all reported, followed by those of Soviet workers on a variety of economic plants. The conclusions reached are that the mutational process has no tendency in one direction or the other, that the vast majority of mutants are recessives, and that the mutation rate depends upon the intensity of the X-rays and not on their wave length. No artificial mutants of established value agronomically have yet been produced and the chief method of creating the variability necessary for selection is still hybridization, though the method of artificial mutations may possibly be of importance in the future.

106. Ducomet, V. 575.257
La greffe considérée sous l'angle chromosomique. (**Grafting considered from the point of view of the chromosomes**).
Sélectionneur 1936 : **5** : Fasc. 1 : 25–32.

The cytology of the graft union is briefly noted and although there may be mixing of the cytoplasm of stock and scion at this point, the author considers that any form of hybridization between their nuclei is out of the question.

The haploid numbers of a variety of plants used as grafts are given and it is shewn that any combination of diploids and polyploids or heteroploids may make a successful graft.

107. DANIEL, L. 575.257:634.13
Nouveaux hybrides de greffe. (**New graft hybrids**).
Rev. Hort. Paris 1936 : **108** : 186–90.
The author cites a number of examples of graft hybrids and in particular two cases from a pear grafted on to a quince which closely resembled the *Pyrocydonia Danieli* of the author.
In conclusion it is pointed out that it is now useless to deny the existence of true graft hybrids.

108. 575.3:576.16:575.24
575.1
KÜHN, A. 575.17
Physiologie der Vererbung und Artumwandlung. (**Physiology of inheritance and species change**).
Naturwissenschaften 1935 : **23** : 1–10.
The subject of this paper has already been reviewed (Cf. " Plant Breeding Abstracts," Vol. VI, Abst. 603).

EVOLUTION 576.12

109. SCHAFFNER, J. H. 576.12
The tendency toward progression or perfective development in plant evolution. Studies in determinate evolution No. IX.
Ohio J. Sci. 1936 : **36** : 80–101.
A discussion of the main trends of evolution in the vascular plants, in which the principle that evolution is orthogenetic and progressive towards a more perfect and more exactly determined form is illustrated by numerous examples.

CYTOLOGY 576.3

110. WRINCH, D. M. 576.312.32:577.1
On the molecular structure of chromosomes.
Protoplasma 1936 : **25** : 550–69.
An account of the author's theories of chromosome structure (Cf. " Plant Breeding Abstracts," Vol. VI, Abst. 452).

111. NAWASCHIN, M. 576.312.4:576.353
Chromosomenanordnung und Chromosomenanomalien in somatischen Metaphasen und ihre Bedeutung für die Theorie der Chromosomenindividualität. (**Chromosome arrangement and chromosome anomalies in somatic metaphases and their significance for the theory of the individuality of the chromosomes**).
Ber. dtsch. bot. Ges. 1936 : **54** : 279–90.
A large series of observations was made in the chromosome configurations at metaphase in adjacent and therefore closely related cells in meristem tissue of the root of *Crepis capillaris*. The remarkable similarity generally found in the chromosome arrangement is regarded as evidence that the chromosomes retain their individuality and arrangement in the resting nucleus. This contention is also supported by data on chromosome similarity between adjacent cells, the nucleus of one of which has rotated as a whole on its axis, and is still further strengthened by evidence from instances of structural changes in the chromosomes with special reference to behaviour in ring formation.
Some speculations on the mechanical forces underlying the rotation of the nucleus and on the role of the centrosome conclude the paper.

112. Dermen, H. 576.354.4
Chromosome complex at premeiotic anaphase and meiotic metaphase.
J. Arnold Arbor. 1936 : **17** : 42–46.

Evidence is presented which shews that duality already exists in the last premeiotic anaphase chromosomes which are destined to become meiotic leptotene threads, while the meiotic metaphase chromosomes are shewn to be eight-parted in the pollen mother cells. It is argued that the same is true of the chromosomes of the embryo-sac mother cells. The special treatment which enabled these observations to be made is described.

113. Câmara, A. de Sousa da 576.356.2:537.531
Existirão porventura cromosomas ramificados ? (**Do branched chromosomes perchance exist?**)
Rev. Agron., Lisboa 1936 : **24** : 64–87.

Among a large number of possible cases of a lateral satellite encountered in observations on a variety of economic plants, only one was sufficiently clear to leave no possibility of doubt ; this was a chromosome of *Vicia onobrychioides* with a satellite attached close to the secondary constriction. A search for similar structures was made in material of *V. macrocarpa*, *V. narbonensis*, *Triticum monococcum* and *T. aegilopoides* that had been subjected to various treatments ; they were found however only in *V. narbonensis*. In X-rayed material of *Aloe arborescens* and *V. Faba* however their appearance was quite frequent. The trabant was always ephemeral and usually disappeared before metaphase, being evidently absorbed in the chromosome. The trabants are thus thought to be a stage in the formation of minute translocations, of whose occurrence they therefore form an indication.

114. Sveshnikova, I. N. 576.356.2:575.127.2:635.651:576.16
(**Translocations in hybrids as an indicator of " karyotype evolution "**).
Biologičeskii Žurnal (Biologicheskij Zhurnal) 1936 : **5** : 303–26.
Sveshnikova, I. and Belekhova, Ju.
(**Translocations in an interspecific hybrid**).
Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 63–70.

An examination was made of the chromosomes of *Vicia sativa* and of the related species. On morphological grounds the small sixth chromosome *F* in *V. sativa* is evidently homologous with the *F* chromosome in the other related 6 chromosome species. The *A* and *E* chromosomes are apparently also homologous in these species and also in the 5 chromosome species such as *V. amphicarpa*. It is thought probably that the *F* chromosome has arisen by fragmentation of the *A* chromosome.

To test this, various crosses between *V. sativa* and other species were made. In the cross with *V. amphicarpa* the characters of this species were mainly recessive in the F_1, which contained 11 chromosomes, 6 from *V. sativa* and 5 from *V. amphicarpa*. The small *F* chromosome conjugated with the *A* chromosome of *V. amphicarpa*, often leading to the formation of a trivalent consisting of one small chromosome and two large ones. This shews that part of the *A* chromosome of *V. amphicarpa* is homologous with the *V. sativa A* chromosome and part is homologous with the *F* chromosome, supporting the assumption as to the origin of the *F* chromosome.

Among a large F_2 population examined, a number of aberrant forms appeared, in which various new characters were observed. One of the plants contained an *F* chromosome reduced to less than half its normal size and an *A* chromosome correspondingly larger in dimensions, with a median attachment constriction. All the progeny of this plant contained either 10 chromosomes, i.e. two normal *V. amphicarpa A* chromosomes, or were of the mutant type, which is evidently a translocation between *A* and *F*. All the mutants types proved heterozygous on further breeding and it appears that the homozygote is lethal. The mutants are distinguished by the bent or humped tube of the flower, a character absent both in the parents and in the other hybrids. They are quite fertile.

The small chromosome of the mutant always conjugated with the two large *A* chromosomes, forming a trivalent, further illustrating their origin by translocation.

This process of translocation is thought to have occurred frequently in nature following upon natural hybridization, and to have been responsible also for the gradual increase in size of the *F* chromosome in the various species and also in the two races of *V. angustifolia*, *dolichosomica* and *brachysomica*, in which case it has occurred at the expense of the *E* chromosome. Crosses were therefore made between *V. sativa* and *V. angustifolia dolichosomica* and as expected a chain of four chromosomes was observed at meiosis in the F_1, consisting of the two *E* chromosomes and the two *F* chromosomes.

A race with an extra chromosome may be formed as a result of translocation in a trisomic. In this way Dubinin has increased the number in *Drosophila* from 4 to 5. The origin of the *F* chromosome in *V. sativa* is ascribed to a similar process, from an original type with 5 chromosomes similar to the present species *V. amphicarpa*. This assumption is supported by the two-armed nature of the *A* chromosome in *V. sativa*, indicating its secondary nature, the more primitive nature of *V. amphicarpa* from a morphological point of view and its smaller area of distribution and the fact that *V. sativa* is never found wild. The conjugation between the *F* and *A* chromosomes in the hybrid with *V. amphicarpa* and the production of the mutant by crossing-over shew that the *F* chromosome retains some genes at least that are homologous with the *A* chromosome genes, though not enough to make them conjugate in the pure species. As a result of this homology and the possibility of crossing-over, a whole series of new forms can be obtained by a continuation of the process of translocation and the "primary" mutant becomes a source of a quantity of further "secondary" mutants such as the one obtained in the cross with *V. amphicarpa*. In this way the series of natural species in which the proportions of the size of the *F* chromosome to that of the *A* and *E* chromosomes increase successively, has probably arisen. Such changes are not abnormalities, but the natural result of the chromosome condition of the original translocated mutant with the small extra chromosome. The mutant obtained in the cross with *V. amphicarpa*, though self-fertile, was sterile with its parents and if it had arisen in nature would have remained isolated. These results therefore illustrated the role of interspecific hybridization in the origin of new chromosome types and new chromosomes. In view of the new knowledge on the position effect of the gene, this is of great evolutionary significance, which is illustrated by the production of an entirely new flower type in the mutant under investigation.

115. Xavier, L. P. 576.356.5
Polyploidia natural e artificial. (**Polyploidy, natural and artificial**).
Rodriguésia, Rio de J. 1936 : **1** (4) : 3–8.

A brief outline is given of the various kinds of polyploidy and their significance, especially in connexion with the formation of interspecific hybrids of balanced chromosomal constitution, such as autosyndetic hybrids and amphidiploids.

116. Lindstrom, E. W. 576.356.5:576.12
Genetics of polyploidy.
Bot. Rev. 1936 : **2** : 197–215.

The different types of gene segregation in polyploids are described, then the general effects of polyploidy, in particular on cell, nuclear and chromosome size, and the paper concludes with a brief account of the evolutionary significance of polyploidy. Its immense importance in plants is emphasized and it is suggested that this is due to its affording extra gene loci for new mutations.

117. Heilborn, O. 576.356.5:576.354.46
The mechanics of so-called secondary association between chromosomes.
Hereditas, Lund 1936 : **22** : 167–88.

Chiefly as a result of his observatons on *Carex* species, the author arrives at the conclusion that the so-called secondary association is not due to genetic affinities between the chromosomes concerned but is due to a sorting and associating effect of the forces of nuclear division on chromosomes of different sizes.

118. 576.356.5:578.089
635.64:576.356.5

Favorsky, N. V.

(Plant tumours and production of mutation by Jørgensen method).

Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 71–123.

Experiments on a number of plants of different species within the *Solanaceae* have shewn that different species vary very much in the ease with which they regenerate after decapitation *Solanum Lycopersicum* and *Datura Metel* regenerated with great ease, others less readily and with *Nicandra physaloides* no regeneration at all was obtained. In most cases where no regeneration direct from the callus came about, there was a marked tendency to produce adventitious buds in the axils of the nearest leaves and these were found to be in no way different from those that form on the cut surface. By using these adventitious axillary shoots it is thought that the range of plants to which the decapitation method is applicable may be very much extended. The present investigations are however limited to the material obtained direct from the main callus. In the species where regeneration from a callus after decapitation is most difficult, the most successful results are obtained not from young plants such as were used by Jørgensen, but from mature plants at the height of their vegetative vigour, even in some cases from plants that have begun to flower. Detailed descriptions are given of the callus development in the different species tested. The histology of the various tumours, of varying kinds and degrees, both benignant and malignant, formed from the callus at the cut surface of a number of the species is also described in detail. In these tumours, giant cells were frequently observed, many of them containing three, four and even up to eight nuclei. Great differences were observed in the size and form of the shoots arising from the callus and the leaves upon them and it was impossible to distinguish the tetraploid shoots from diploid by their mere size as done by Jørgensen. These were the only differences observed in *Solanum Lycopersicum*, the flower characters being all quite normal. In *Datura Metel* and other species observed, various floral abnormalities were also noticed on the regenerated shoots ; most of these gave abnormally small seeds of reduced viability ; the abnormalities observed were too extreme to be the result of tetraploidy alone.

Chromosome counts were made on the root tips of 280 plants obtained from regenerated shoots of *S. Lycopersicum* ; chromosome aberrations were observed in fourteen of them, two of which had 25, seven 48, two 50 and one 59 + 2 fragments ; two further plants were chimaeras with varying chromosome number. The morphology and relative size of the chromosomes in these plants lent no support to the supposition that the increased chromosome numbers arose by fragmentation and their origin is ascribed to true chromosome aberration. The tetraploids were distinguished by greater vigour of growth, the others by reduced vigour and various deformities. Thus although the total number of mutants amounted to 5 per cent, the number of tetraploids was only 2.5 per cent. An examination of Jørgensen's results shews that he also obtained very little more than this proportion.

Of the two chimaeras one had roots containing cells with 24, 48 and 36, the other cells with 24 and 25 chromosomes. Among some of the shoots with normal chromosome number there were indications of changes in size or form of the chromosomes and it is probable that a closer examination will reveal further anomalies.

Of ten shoots of *Physalis peruviana* examined, two proved to be tetraploids, whilst all ten shoots of *Datura Metel* were normal in chromosome number. In one of the deformed plants of *D. Stramonium* many chromosome irregularities were detected, especially in the pollen mother cells and pollen grains, where chromosome numbers below 12 were nearly always observed, mostly varying from 3 to 9. Pairing was also abnormal or absent. The plant formed a certain number of seeds, which however were all under-sized. They germinated however ; but from 253 seedlings only 50 plants were obtained. These shewed varying chromosome numbers, some 24, some 23, some 25 and one 16, thus approaching haploidy. Similar aberrations were observed in other plants and there is no doubt that decapitation, in this species at least, leads not only to polyploidy but to the production of a variety of mutations.

119. 576.356.5:581.9:575.3
ROHWEDER, H. 575.3:631.4
Die Bedeutung der Polyploidie für die Anpassung der Angiospermen an die Kalkgebiete Schleswig-Holsteins. (**The significance of polyploidy for the adaption of the angiosperms to the chalk districts of Schleswig-Holstein**).
Beih. bot. Zbl. 1936 : **54** : 507–19.

Studies of the plant populations of various districts of Schleswig-Holstein revealed a high percentage of polyploids in chalky soils while diploids predominate on sandy soils and heaths poor in lime.

A high selective action in favour of polyploids and against diploids is attributed to chalky soils. This adaptation of the polyploids, is, however, apparently no longer effective when sodium chloride is also present in the soil. (Cf. " Plant Breeding Abstracts," Vol. VI, Abst. 460 and Vol. V, Abst. 922).

BOTANY 58

120. ALVAREZ-LAVIADA, M. M. 581.162.3:578.08
Extractor de polen, muy útil en la hibridación y polinización. (**A pollen extractor, very useful in hybridization and pollination**).
Agricultura, Madrid 1936 : **8** : 434–36.

An apparatus is described which consists of a small cylinder equiped with a fine gauze at one end, into which a number of anthers can be introduced. The gauze top is fitted and the apparatus is shaken vigorously by means of a handle. In this way the pollen is expressed and can be collected on paper and stored in receptacles. For pollination of large numbers of flowers of *Citrus* and other fruits a great saving of pollen is effected, since it can be applied with a brush, and the avoidance of risk of impurity and other similar advantages form a strong recommendation of the method for practical use.

121. VASIL'EV, JU. P. 581.162.3:581.331.23
(**Physiological method of choosing pollinators. II. Influence of different parts of the pistil on pollen germination**).
Naučnoe Plodovodstvo (Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow. I. V. Michurin) 1936 : No. 1 : 39–60.

Experiments were made on the germination of pollen in a drop of sugar solution as a control and in various experimental series consisting of the sugar solution with the addition of the stigma—with the cut surface blocked with paraffin so that the wound substances could not escape—with a piece of the style and with the ovule.

In cherry pollinations different combinations of parents shewed different reactions. In one group of combinations the addition of the stigma and ovule clearly stimulated pollen tube growth ; this group could be subdivided into those shewing a high and those with low germination percentage of the pollen. A third group shewed no influence of either, whilst still another group was stimulated by the stigma and retarded by the ovary ; a fifth group was indifferent to the stigma and retarded by the ovule and the remaining group retarded by both. This sixth group was entirely sterile, the fifth was partially so, while groups 1 to 4 were almost or entirely fertile. The results obtained by this method agree with the results of pollination tests in the field but provide a finer, as well as much more rapid, method of distinguishing between the suitability of different parental combinations for pollination. The best combinations of the varieties tested are indicated.

Similar results were obtained in experiments with apples and pears.

FIELD TESTS 631.421

122. MA, P. C. and FAN, F. C. 631.421
(The new arrangement of field experiments according to randomized methods).
J. Agric. Ass. China 1936 : No. 149 : 14–30.

A presentation of modern statistical methods for Chinese readers. J. W.

INTRODUCTION OF NEW SPECIES 631.524

123. VAVILOV, N. I. 631.524:551.566.1
(General principles for the introduction of new plants into the Soviet subtropics).
Soviet Subtropics 1936 : No. 6 (22) : 3–18.

The author points out that the cultivation of *Citrus*, tea and other plants in the Soviet subtropics at present is only possible because suitable hardy forms were chosen for introduction,thereby illustrating the immense importance of making available the full natural resources of a given plant before attempting to utilize it and especially before starting breeding work. It is in this respect that geographical studies are of primary importance, the object being to study the detailed distribution not only of the species but of the individual varieties and characters within them, especially the characters of economic importance, such as hardiness in the case of the Soviet subtropics. An examination of all other subtropical countries shews their agriculture to be based on judicious introduction from abroad. The experience of the Soviet botanists has shewn however that though a plant may be a native of the subtropics it may quite often thrive equally well in the extreme north, e.g. within the arctic circle.

The Soviet humid subtropics were subjected to the ravages of the ice age and so lost many of the plants which have persisted in other subtropical regions and can now with success be introduced again. The first and main source of material, both on account of its extraordinary richness and the similarity of the climates, is S.E. Asia, especially China—tea, *Citrus* fruits, tung oil, the rubber tree *Eucomia*, persimmon, *Eriobotrya*, ramie and the majority of ornamentals all come from China and the great wealth of the country remains very little investigated ; China is of particular interest in containing the most hardy and early maturing forms of a great number of subtropical fruits, and possesses absolutely untouched sources of persimmon, tung, tea, bamboo and others, which probably contain numbers of new forms and even species whose existence has not hitherto been suspected.

Next in importance comes the Indian centre, the foot-hills of the Himalayas, containing the lemon and many other *Citrus* fruits, sugar cane, and many spices and medicinal plants.

Then come the South and Central American centres, containing the avocados, *Agave*, *Cinchona*, *Passiflora* and many other tropical fruits and medicinal plants.

The Australian and New Zealand centre contains New Zealand hemp, eucalyptus, *Casuarina* and *Acacia*, the South African centre geranium and many ornamentals.

The most promising sources of introduction for the arid subtropics are the centres of Iran and Turkey and neighbouring countries of the Near East, containing the best sorts of fig, almond, pistachio, pomegranate, and Transcaucasia and the neighbouring countries are also of interest in this connexion.

The Mediterranean centre is of interest for the olive, fig, carob, cork oak, laurel, damask rose, lavender, rosemary, oleander and a number of forage plants.

One of the essentials in making use of the material introduced from these new sources is to examine it from every point of view, cytological, genetical, chemical and physiological investigations all being carried out side by side. In this way the innate value of much externally unpromising material has been realized, as in the case of the new South American potato species.

PLANT DISEASES 632

124. 632–1.521.6:575
VAVILOV, N. I. 632.7–1.521.6:575
(The study of the immunity of plants to infectious diseases).
Sel'khozgiz, Moscow and Leningrad 1935 : Pp. 100.

In this monograph the author reviews the extensive work that has been done in recent years on immunity in plants. The nature of immunity, natural and acquired, is first considered and the factors affecting it are analysed. The genetics of immunity and the breeding of resistant varieties

are the next topics for consideration, in which the view is expressed that the chances of success in breeding are directly proportional to the degree of specialization of the parasite on the one hand and of the host plant to be dealt with on the other.

The vast amount of new knowledge and new material collected by Soviet botanists and covering the whole range of cultivated plants has placed the problem of breeding for resistance on a new and firmer footing. Special mention in this connexion is made of the wild potato species from Mexico (*Solanum demissum*, *S. Antipoviczii*, etc.) resistant to blight, the new Georgian wheat species *Triticum Timopheevi*, resistant to a whole range of fungous diseases and others. This illustrates the importance of distant hybridization in breeding for resistance and the work of investigators in America, Germany and other countries on these lines is reviewed. In this connexion the value of Koston's method of polygenom hybrids in making otherwise impossible combinations of parental species is mentioned.

There is a full and very valuable review of the work done up to the present on breeding for resistance to insect pests in a number of different plants and the monograph terminates with a selected and classified bibliography.

125. Holton, C. S. 632.451.2:575.11

Inheritance of chlamydospore characteristics in oat smut fungi.

J. Agric. Res. 1936 : **52** : 535–40.

A preliminary experiment shewed that the distribution of characters in F_2 chlamydospores could be determined by inoculating with F_1 chlamydospores and using each smutted panicle as an individual. By this method as well as by the crossing of F_1 monosporidial lines an F_2 ratio of 3 brown : 1 hyaline was obtained from the cross *Ustilago levis* x buff smut fungus (Cf. " Plant Breeding Abstracts " Vol. IV, Abst. 361 and Vol. VI, Abst. 1179).

In hybrids between *Ustilago avenae* (chlamydospores echinulate) and *U. levis* (chlamydospores smooth) the F_1 chlamydospores were echinulate and segregation into 3 echinulate : 1 smooth occurred in F_2.

A cross was also made between *U. avenae* (brown, echinulate) and the buff smut fungus (hyaline, smooth). The F_1 chlamydospores were brown and echinulate and in F_2 segregation occurred into 9 brown, echinulate : 3 brown smooth : 4 hyaline smooth, the expected hyaline echinulate class being absent. This, it is suggested, is due to an inhibition of the factor for echinulation of hyaline spores.

126. 632.951.1–1.532.3:581.192.6

Drain, B. D., Gnadinger, C. B., Corl, C. S., and Shuey, G. A.

Further experiments with high test pyrethrum strains.

Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 201–04.

Analyses indicate that the high pyrethrin content of selected strains (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 114) is maintained under vegetative propagation.

ECONOMIC PLANTS 633

127. 633
633.6
634.45
634.661

(New food and sugar plants).

Bull. Appl. Bot. Leningrad 1935 : Ser. XI (2) : Pp. 163.

A general account is given of *Colocasia antiquorum*, its geographical distribution, history, systematics, biology and varieties, the chief representatives of which from all different cultivating countries are described. The methods of cultivation of the plant are given and a scheme for breeding work to be carried out in the U.S.S.R. is outlined. The chemical composition, nature of the starch, and methods of utilization are also discussed.

Similar information is given for a number of other root crops, including *Uanthosoma*, *Maranta*, and for *Cyperus esculentus*, chicory and its numerous varieties, *Diospyros* and *Hovenia dulcis* and other species, with indications of the prospects of their cultivation in the Soviet Union.

128. Sessous. 633:575(43)
Zeitgemässes aus den Arbeitsgebieten des Instituts für Pflanzenbau und Pflanzenzüchtung der Landes-Universität Giessen. (**Current topics from the work of the Institute for plant culture and plant breeding of the National University of Giessen**).
Ernähr. Pfl. 1936 : **32** : 169–72.
A brief review of some of the results obtained and the work in progress at this institution. Good yields and bread of good quality have resulted when certain varieties of spring wheat are sown in the autumn.
The work on breeding soya beans for earliness and higher yields is also of interest for plant breeders.

129 633:576.16(8)
Parodi, L. R. 631.524.4(8)
Relaciones de la agricultura prehispánica con la agricultura Argentina actual. Observaciones generales sobre la domesticación de las plantas. (**Relations of the aboriginal agriculture to the agriculture of present-day Argentina. General observations on the domestication of plants**).
An. Acad. Nac. Agron. Veter. B. Aires 1935 : **1** : 115-67.
The extreme importance of the indigenous agriculturists in the past in the domestications of the local plants is discussed with numerous examples. The development of many of the local plants is so high, in fact, that it will be extremely difficult even with modern methods, to affect any further improvement. Descriptions are then given of the conditions of climate, etc., and of the local agriculture in the main regions of South America, with indications of the plants cultivated in each. Most of these are very incompletely studied and a closer investigation of this material will almost certainly provide much of value to plant breeders. A start on these lines is being made by the Argentine department of agriculture.

130. Matsuura, H. and Sutô, T. 633:576.312
Contributions to the idiogram study in phanerogamous plants. I.
J. Fac. Sci. Hokkaido Univ. 1935 : Ser. V : **5** : 33–75.
A large collection of living plant material was made with the object of preparing exact data on the number, size and configuration of the chromosomes of phanerogamous plants and on their karyotypes. Cytological descriptions (accompanied by camera lucida drawings) of 167 plants including a number that are of economic interest are presented in this paper.
Further studies of the same kind are contemplated.

131. 633:578.087
(**Variety testing in the laboratory**).
Bull. Appl. Bot. Leningrad 1936 : Ser. IV (1) : Pp. 92.
In this collective work observations are reported which were made on a large number of varieties of different crop plants with the object of finding the characters of most value in distinguishing the varieties in the laboratory and of determining varietal purity.

A. P. Timofeeva and A. S. Zavylenkova. — *Identification of the seeds of wheat varieties by a laboratory method.* (*pp. 5–23*).

The number of secondary roots, the colour of the grain after treatment with phenol, the colour of the coleoptile, the pubescence of the first leaf, the rate of growth of the second leaf, and the pubescence of the leaf sheath were all characters found to be of diagnostic value.

K. A. Repnikov. — *Laboratory method of testing the seeds of wheat and barley by means of phenol and sulphuric acid.* (*pp. 25-40*).

This new method of distinguishing varieties was found to have many advantages and to be capable of separating many varieties which are very difficult to distinguish by field observations.

K. W. Kamensky and T. A. Orechova. — *The possibility of using the ultra-violet light of a quartz lamp for determining the genuineness of seeds.* (*pp. 41–55*).

The method was found useful for a great variety of crops.

M. K. Volodkovitsch. — *Comparison of the laboratory and field methods of variety diagnosis in oats in the Kuibyschev district.* (*pp. 57-63*).

The observations shewed it to be possible to replace field observations by laboratory control when suitable methods are employed.

T. A. Orechova and S. M. Lapinskaja. — *Morpho-anatomical distinctions between the seeds of cabbage varieties.* (*pp. 65–76*).

Various anatomical peculiarities are described whereby the seeds of cabbage, savoy, cauliflower, Brussels sprout and kohl-rabi can be distinguished and a key is given for their determination.

A. A. Awakjan. — *Determination of species of onions by the morpho-anatomical characters of their seeds.* (*pp. 77–85*).

Anatomical and histological features of the seeds of various species of *Allium* are described and illustrated, for the purpose of their determination in the laboratory.

A. N. Gudkov. — *Comparison of the chemical and morphological methods of recognizing Pisum arvense among seeds of P. sativum.* (*pp. 87–92*).

The results of the two methods agreed but the chemical method of treatment with potassium bichromate was found to be the more satisfactory.

132. JANSONS, E. 633:581.162.3:576.12

Über die Kreuz- und Selbstbefruchtung der Pflanzen. Ein blütenbiologischer Beitrag. (**Cross and self-fertilization of plants. A contribution on the biology of flowering**).

Acta Hort. Bot. Univ. Latv. 1934/35 : **9/10** : 143–226.

A discussion of the theories and findings of Darwin and the various workers before and after his time with the results obtained by the author from observations on 158 species which included a few economic plants. In conclusion, the genetic importance of cross-fertilization in homogamous, herkogamous and dichogamous forms is recognized with, however, due regard at the same time to the significance of self-fertilization in the production of constant characters.

133. FRISQUE, K. 633:581.162.5

De quelques types de stérilité chez les plantes et de leur signification en horticulture. (**On some types of sterility in plants and their significance in horticulture**).

Ann. Gembl. 1936 : **42** : 181–96.

An explanatory survey of the effects of environmental factors, floral structure and function, polyploidy and sexual incompatibility in producing sterility. A bibliography is appended.

134. 633–1.524.4(63)

250 Weizen- und Gerstenvarietäten in Abyssinien. (**250 wheat and barley varieties in Abyssinia**).

Umschau 1936 : **40** : 423–24.

Reference is made to the valuable discoveries of plant resources in Abyssinia made by the Russian botanists and reviewed from time to time in " Plant Breeding Abstracts ".

135. 633.00.14
(Variety testing of the main agricultural crops. III. Cereals, legumes oil plants, cucurbits and potatoes).
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Var. Testing Service 1935 : Pp. 232.
Complete details are given of the method of carrying out the observations involved in variety tests of all the main cereals, oil plants, legumes, potatoes and cucurbits, including descriptions of all the main diseases and pests, of methods of estimating shedding in cereals, of growing potatoes from seed, of variety testing after vernalization and other special problems.
A list of the varieties and the diseases referred to and their places of origin terminates the volume.

136. KNJAGINICEV, M. I. 633.00.14:581.192:581.181
(Methods of variety testing in the main agricultural crops. VI. Methods of analysis and organization of the work of large-scale laboratory estimation of plant products).
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Var. Testing Service 1936 : Pp. 70.
In this further number of the series on the carrying out of variety tests, descriptions are given of the methods used for estimating all the main elements and important plant products such as protein, oils and fats, starches, sugars, cellulose, enzymes and others. In an appendix tables are given for converting various readings into percentages of a given substance, such as nitrogen into protein, refractometer readings into percentage dry matter, etc., etc.

CEREALS 633.1

137. MUDRA, A. 633.1:576.341:575.1
Weiteres über Zellsaftkonzentration beim Getreide.. (**Further studies on the concentration of the cell sap in cereals**).
Z. Zücht. 1935 : A **21** : 59–67.
In continuation of previous work (Cf " Plant Breeding Abstracts " Vol. V, Abst. 665) the author now sets out to shew that the concentration of cell sap is a varietal character due, in the first place, to internal factors.
Crosses were made between varieties of wheat with marked differences in concentration, and the F_1 progeny was intermediate ; varietal differences were also found in barley and oats. In general, varieties with the highest concentration were most high-yielding.

138. HARRINGTON, J. B. 633.1–2.111–1.521.6
Varietal resistance of small grains to spring frost injury.
J. Amer. Soc. Agron. 1936 : **28** : 374–88.
Advantage was taken of a frost on June 4, 1935 to make observations on the resistance of numerous varieties of wheat, barley and oats to frost. In general it was observed that susceptibility was conspicuous in varieties whose ancestry included a high proportion of warm-climate forms ; varieties whose ancestors were mostly from cold climates were frost-resistant.

139. PECH, W. 633.1–2.183:578.081
Neue Methode zur Bestimmung der Standfestigkeit des Getreides. (**A new method for the determination of standing capacity in cereals**).
Z. Zücht. 1936 : A **21** : 46–58.
The apparatus is described whereby seedlings in the first leaf stage may have their standing capacity determined.
The method has the great advantage for the plant breeder that this character may be distinguished during the winter months.

140. 633.11 Åring II
633.11 Standard II
BERG, S. O. 633.11:575(48.5)
Två nya höstvetesorter. (**Two new winter wheats**).
Weibulls Ill. Årsb. 1936 : **31** : 33–35.

Åring originated from a cross between Ankar I and Saxo and Åring II is a selection from the same cross.
Standard II is a selection from Standard which it closely resembles, except for increased yield.

141. 633.11 Atle
BERG, S. O. 633.11:575(48.5)
Weibulls Atle-vårvete. Ny sort för Skånes slättbygder med extremt kort och styvt strå, mycket hög avkastning och utmärkt kärnkvalitet. (**Weibulls spring wheat Atle. A new variety for the plains of Scania with extremely short and stiff straw, very high yield and excellent grain quality**).
Weibulls Ill. Årsb. 1936 : **31** : 29–32.

Atle wheat represents the successful result of the new method for improving spring wheat by crossing with winter varieties. The parents in this case were the spring variety Extra Kolben and the Winter wheat Saxo. Out of 22 yield tests Atle wheat has proved superior to Extra Kolben II in 21 and in shortness of straw it closely approaches the ideal type.

142. FRENKEL, A. JA. and NEČIPORENKO, N. A. 633.11:551.566.3:575
(**Testing the wheats of the world collection under the conditions of Tuva**).
Bull. Appl. Bot. Leningrad 1935 : Ser. A (16) : 59–66.

The behaviour of the world collection of wheats in the republic of Tuva in Central Asia, with its severe continental climate, was observed. Only those varieties with the shortest period from earing to maturity and with a low heat requirement during this period were successful, on account of the early onset of the autumn frosts. This is the type at which breeders must aim for all regions with this type of climate, as for example Siberia, Altai and the extreme north.
The local wheats of Tuva are in this respect of especial interest for breeding.

143. IVČENKO, L. A. 633.11:551.566.3:575
(**The type collection of winter wheats in conditions of the western Ukrainian steppes**).
Bull. Appl. Bot. Leningrad 1936 : Ser. A (18) : 141–46.

Observations were made on different groups of the world collection of wheat in respect of frost resistance, and earliness and the data are tabulated. Very few were equal to the Soviet standards in hardiness, the earlier varieties were those from Japan, China and India, the best of which matured 5–10 days earlier than Kooperatorka. Soviet breeders will have to study all the wheats of the collection on the phasic principle of Lysenko and so reveal their hidden possibilities for breeding for the two characters here considered.

144. KOSTJUČENKO, I. A. and KALININ, P. K. 633.11:551.566.3:575
(**Prospects of breeding wheat in the conditions of the extreme north**).
Bull. Appl. Bot. Leningrad 1936 : Ser. A (17) : 43–57.

The meteorological conditions of Hibiny, the extreme northerly research station within the arctic circle, and the behaviour of a number of different groups of wheat under these conditions, are described. The most suitable for breeding early forms for the arctic zones are the western Siberian wheats on the one hand and the wheats from India and some mountainous parts of Afghanistan on the other. All these have a very short period from germination to earing, whereas in the phase from earing to maturity the Siberian wheats were more reliable than the Indian wheats, which latter only came to maturity in sufficiently warm years. The Siberian group was also distinguished by high tillering capacity and a large number of spikelets per ear, as a result of which however, their grain is more uneven in form and degree of maturity than the Indian group.

Another valuable feature of all these wheats, with the exception of the Afghan group, is the capacity to ripen in the stook after harvesting.
The greatest success is anticipated from crosses of geographically distinct groups such as the above, on the principle propounded by Lysenko, and the application of vernalization is recommended before making the choice of particular varieties.
A list of desiderata to be taken into account in breeding wheats for the extreme north is given.

145. HANISCH, H. 633.11:575(43.72)
Ueber Ertrag und Qualität im Weizenbau. (**On yield and quality in wheat cultivation**).
Verlautb. dtsch. Sekt. mähr. Landeskulturrat. 1935 : **36/12** : No. 5 : 79–81, No. 6 : 105–08.

The features demanded of a good variety of wheat are high and reliable yielding capacity, good quality, density of ears forming the stand and high yield from the individual ears. Among the external factors, the water supply, and among the internal factors, the osmotic pressure are of great importance. For dry areas the number of ears per unit of area is more important than the yield of the individual ears, hence denser sowing is necessary. In this connexion the Zidlochovice Station is carrying out experiments on spacing. No further increase as regards the yield can be expected to be combined with the improvement in quality being carried out by methods of breeding. But the varieties must be reliable as regards yield, i.e. not good in one year and bad in another year and the varieties must also be able to withstand unfavourable conditions. Since in the case of wheat it is even less possible than with other crops to breed universal varieties, it appears necessary to breed several different varieties. By crossing, opposing characteristics can be combined. Quality has become a very essential factor at the present day. This feature can be estimated by various means, best with the farinograph and fermentograph of Hankoczy-Brabender. Co-operation between the breeder, the farmer and the wheat industry is necessary.
A.B.

146. BERG, S. O. 633.11:575(48.5)
Svensk veteförädling. Weibullsholms insats under trettioårsperioden 1904–1934. (**Swedish wheat improvement. Weibullsholm's contribution during the thirty year period 1904–1934**).
Weibulls Ill. Årsb. 1935 : **30** : 5–23.

The work already accomplished in the improvement of winter wheat is briefly reviewed and the history of some of the most important forms is traced. The present work consists mainly in an effort to improve the baking quality of winter wheat and in this work the wheat von Baron has proved of great value as a parent.
In spring wheat, improvement is desired in stiffness of straw, in yield and in baking quality.
Crosses between spring and winter wheats have been made as well as between spring wheats.

147. NIEVES, R. 633.11:575.11
Herencia en la cruza Kanred x Florence (Cheg 27–7 x). [**Inheritance in the cross Kanred x Florence (Cheg 27–7 x)**].
Noticias Agric., Min. Agric. Nac., Direcc. Gen. Agric., Div. Estac. Exp. Secc. Fitotecn., B. Aires 1935 : **2** (6) : Pp. 23.
Physis B. Aires 1936 : **12** : 118–20.

Erect habit was dominant in F_1 and the F_2 contained erect and procumbent plants in the ratio 3 : 1 which was confirmed in F_2.
Red grain colour was dominant, with a 63 : 1 ratio in F_2, whilst the presence of three factors was confirmed in F_3.
The early earing date of Florence proved in F_1 to be dominant but in later generations intermediate, three pairs of factors being operative.
Florence being awnless (with short tips as most *vulgare* wheats) and Kanred strongly awned, the F_1 was without full awns but with tips distinctly longer than the Florence parent being of the type *submutica*. A qualitative classification of the F_2 gave a ratio of 3 *mutica* : 9 *submutica* : 3

subaristata : 1 *aristata*. A bifactorial hypothesis was confirmed by actual measurements of the lengths of the awns. In the F_3 no form appeared with awns as long as Kanred. This is explained by assuming that the two factors are unequal in their action, the main factor being necessary in the homozygous condition to produce full awns, and the second factor serving to increase their length ; it is also assumed that two further pairs of modifying factors are also at play. The fully awned type was recovered when a larger F_3 family was studied.
Low tillering of the Florence type was found to be dominant and governed by a single factor pair. The tall straw of Kanred was dominant and bifactorial, while ear density shewed transgression in F_2, the figures approximating nearest of all to a bifactorial ratio 9 : 7.
All possible correlations were tested between the characters studied. Positive correlations were established between height of plant and number of ears, and between number of ears and number of tillers. These are obviously correlations of a physiological nature and it is concluded that no genetic association exists.

148. MÜLLER, K. O. 633.11:575.11"793"
Zur Kenntnis des Sommer-Wintertypus bei *Triticum vulgare* auf Grund von genetischen und entwicklungsphysiologischen Untersuchungen an anatolischen Weichweizenformen (Vorläufige Mitteilung). [**Information on the spring-winter type in *T. vulgare* on the basis of genetical and developmental investigations on Anatolian soft wheats (preliminary note)**].
Angew. Bot. 1936 : **18** : 231–39.
Experiments on a large number of wheat forms have shewn that the so-called alternative wheats (Wechselweizen) are only the intermediate forms of a more or less continuous series of types represented by the pure spring wheats at the one extreme and the pure winter wheats at the other. A test of 72 wheat varieties in Central Europe and 24 in Anatolia has shewn that winter-hardiness is also very closely correlated with the winter habit and though in some countries there would be distinct advantages in having a cold-resistant spring wheat, such a combination has not yet been found. This argues against the assumption that the two characters winter habit and winter hardiness are genetically entirely independent and that their association is merely the result of the parallel effect of natural selection. Genetical experiments have shewn that there exists a factor complex for cold resistance, which is transmitted independently of the factors determining the low temperature requirements of the plant, i.e. the degree of winterness. These latter factors, however, influence the rapidity with which the potential cold resistance comes into action and also its duration, in such a way that the duration of the cold resistance increases with increasing cold resistance. The result of this is therefore that the most winter-hardy are those forms with the greatest cold resistance *and* cold requirement. This accounts for the observed predominance of forms with high cold requirement in zones with severe winters, since natural selection for cold resistance has brought with it an increase in the cold requirement. It also explains the absence of cold-resistant wheats of the spring type in nature. A spring wheat with a considerable amount of cold resistance should however be capable of being produced, containing the resistance complex without the cold-requirement factors. Moreover the presence of the full resistance complex in certain spring wheats accounts for the transgression observed in certain crosses between winter and spring forms and makes it desirable to include such forms when crossing for the production of hardy varieties.
The rapidity of development is also inherited independently of the winter or spring type so that it has also been found possible to produce winter wheats capable of ripening almost as early as winter rye when sown in winter.

149. MIÈGE, É. 633.11:575.12–184:581.48
Sur la descendance et la constitution des lignées à fleurs polycarpiques dans un hybride de *Triticum vulgare* H. (**On the origin and constitution of lines with polycarpic flowers in a *T. vulgare* H. hybrid**).
Ann. Sci. Nat. Bot. 1936 : Sér. 10 : **18** : Fasc. 1 : 95–103.
In continuation of the previous study (Cf. " Plant Breeding Abstracts " Vol. II, Abst. 51, and Vol. VI, Abst. 828.) data for the period 1928–1934 are given of the number of multiple grains

obtained in pedigree cultivation of two lines of the hybrid [*Triticum vulgare* H. (var. *alborubrum* "Indian Pearl") x *T. vulgare* H. var. *oasicolum*, "Extreme Sud Algerian")] in which the anomalies of the carpels and grains were first recorded.
In general the percentage of polycarpic flowers and of double and triple grains shewed a tendency to decrease up to 1933, but in one of the lines it rose again in 1934.
The polycarpic form is regarded as being partially hereditary and conditioned by several factors of which at least one appears to be inhibitory.
The morphological features of multiple grains are described. Cytologically the two lines shewed no abberant behaviour and had the same chromosome number as the normal *Triticum vulgare* H.

150. Ščerbina, D. R. 633.11:575.127:581.5
(Crossing ecologically and geographically different races of wheat.
Bull. Appl. Bot. Leningrad 1936 : Ser. A (18) : 65–73.
An examination of the pedigrees of all the best varieties of fruit trees produced by Michurin, and of a great number of the best varieties of other crops such as Marquis wheat, etc., shews that they have been produced by crossing between distant geographical races.
To test the general applicability of this principle to wheat crosses, experiments were made by the method of cyclic crossing, the following combinations being made in 1933 :

1. *Triticum vulgare* v. *erythrospermum* x *Triticum vulgare* v. *lutescens*
(Afghanistan) (Switzerland)
2. *Triticum vulgare* v. *lutescens* x *Triticum vulgare* v. *lutescens*
(Kazakstan) (Switzerland)
3. *Triticum vulgare* v. *lutescens* x *Triticum vulgare* v. *erythrospermum*
(Kazakstan) (Afghanistan)
4. *Triticum vulgare* v. *erythrospermum* x *Triticum vulgare* v. *erythrospermum*
(Afghanistan) (India)
5. *Triticum vulgare* v. *lutescens* x *Triticum vulgare* v. *erythrospermum*
(Kazakstan) (India)

In all crosses the F_1 was more or less intermediate. In the F_2 of crosses numbers 1 and 3 there was a very wide segregation of ear characters including speltoids, compactoids, squareheads, forms with elongated or reduced empty glumes, forms with up to four grains per spikelet, etc. There were also plants exceeding the taller parent by 10 cm. in height, and dwarfs only 10–15 cm. high ; transgressions of 1 to 1·9 cm. ear length in a positive and of 2·2 cm. in a negative direction were observed and an increase of 1½–2 times in the number of tillers. In certain cases transgression for a number of different characters occurred in the same plant and such plants were thus of great interest from a practical standpoint.
Similar transgressions in greater or lesser degree were observed in the other combinations except in cross No. 2, where segregation but no transgression occurred. Evidently the *lutescens* from Kazakstan and Switzerland are genetically closedly allied, though both are very distinct from the *erythrospermum* from Afghanistan. Combination 5 shewed a marked tendency towards positive transgression in ear length, with increases of up to 2·8 cm., and negative transgression in height of plant, many dwarfs appearing, some 33·5 cm. less than the smaller parent ; speltoids and forms with up to four grains per spikelet also appeared. These latter, together with semi-sterile and square-head forms, also occurred in cross No. 4, though the transgression was not so pronounced. These results indicate the genetical distinctness of the Kazakstan and Afghan forms, the Indian form being intermediate between them.
The F_3 results fully confirmed those of the F_2 and similar segregates occurred. The conclusion is therefore reached that the segregation in crosses between geographically distant forms within the species may be just as varied as the segregation in interspecific crosses, the former crosses having the advantage that pure breeding lines are obtained at a much earlier stage than in interspecific crosses. Such crosses are also useful, as seen in the present results, for determining the degree of relationship between forms within the species. A study of this kind is of great importance for the light it sheds on the genetic nature of forms to be used as initial material for breeding and can be of still further value if supplemented by an investigation of the phasic development of the initial forms on the lines propounded by Lysenko.

151. Horton, E. S. 633.11:575.127.2:576.354.4
Studies in the cytology of wheat and of a wheat species hybrid.
Amer. J. Bot. 1936 : **23** : 121–29.

Meiosis in *Triticum durum*, var. Iumillo and in its hybrid with *T. vulgare* var. Marquis is described in detail. Evidence excluding the possibility of telosynapsis was obtained in each case, in particular the occurrence at early pachytene of paired and unpaired threads in the pentaploid hybrid.

The hybrid normally had seven univalents and fourteen bivalents ; occasional trivalents were observed but it is considered improbable that these involved the pairing of any of the normally unmated chromosomes.

152. Kretowitsch, W. L. 633.11:575.127.5:581.192
Charakteristik der Eiweissstoffe der Hybriden von Roggen und Weizen.
(**Properties of the proteins of the hybrids of rye and wheat**).
Planta 1936 : **25** : 64–69.

A comparative study of the proteins of the parental and the hybrid forms of a *Triticum vulgare* (2n = 42) x *Secale cereale* (2n = 14) cross.

An analysis of the milled grain showed that the " Secalotricum" hybrid had a remarkably high ash content and a very low specific gravity ; while an examination of the grain and gluten revealed an unusually high percentage of total nitrogen in the hybrid which furthermore—in spite of the rye complement in its cells—combined the capacity for gluten formation with the proportion of gliadin nitrogen to total nitrogen that is characteristic of rye.

Finally a comparison of the chemical and physical properties of the proteins in the parents and the hybrids showed, 1) a clear difference between gliadin of rye and of wheat ; (2) in rye a higher specific rotation with also a marked difference in the tryptophane and tyrosine content as compared with wheat. The gliadins of the hybrids of subsequent generations and of wheat proved identical as regards tryptophane content and specific rotation.

A parallel is suggested between these biochemical data and the tendency towards dominance of wheat characters over the rye in the amphidiploid.

153. 633.11:575.127.5:633.14:576.356.7
*Lebedeff, V. N. 633.11:575.129:633.14
(**The new phenomena in wheat-rye hybrids**).
Ukrainskii N-I Institut Sakharnoi Promyślennosti Kiev (Sci. Inst. Sug. Ind.) 1932 : Pp. 84.

The desirability of combining the hardiness, vigour and earliness of rye with the quality of the soft wheats is emphasized and early work on wheat-rye hybrids is reviewd.

Large numbers of different wheat lines were pollinated in 1926 with Petkus rye. The success varied very much with the different lines, the central Asiatic wheats displaying a much greater capacity for pollination with rye than any other group, some of them giving as much as 40 per cent success. The F_1 plants were intermediate in many characters and unusually vigorous ; a separate plant was obtained from each tiller by vegetative reproduction and from these an F_2 was obtained by pollination with rye, the F_1 plants being entirely pollen-sterile. About 500 flowers in 17 ears of one hybrid were pollinated with Petkus rye and four grains obtained, of which however only one germinated. The success with other hybrids was less still and the average success of all pollination of the different F_1 hybrids in 1928, involving 30,000 flowers was only 0·09. The F_2 plants showed distinctly more resemblance to rye than the F_1 and certain plants showed unexpectedly high fertility ; an average set of 10·9 per cent was obtained by selfing, 4·5 per cent by pollination with rye.

By further pollination with rye an F_3 was obtained which when examined cytologically was seen to consist of plants almost entirely resembling rye with 14 or 15 chromosomes. The progeny of the unusually fertile F_2 plants however had chromosome numbers varying from 22 to 28. The F_2 plants in question proved to have 14 bivalent chromosomes, and to have a somatic chromosome

* A full summary of this paper is on file at the Bureau.

number of 35. This could only have arisen by the union of a 7 chromosome rye gamete with an unreduced egg cell of the 28 chromosome F_1 formed from 21 wheat and 7 rye chromosomes. This would account for the formation of 7 rye bivalents and the other 7 are evidently formed by autosyndesis between two wheat genoms.

These F_2 plants, being partly fertile, were also self-pollinated and an F_3 was also produced in this way. The chromosome numbers of these F_3 plants varied from 28 to 39, with a predominance of the lower numbers. One of these plants attracted attention because of its exceptional fertility and unusually pronounced rye type ; it had an average of 72·0 per cent good pollen. This hybrid proved to have 14 regular paired bivalents and no extra univalents ; occasionally one, or sometimes two, of the pairs failed to conjugate, giving 2 or 4 univalents, but the total chromosome number was always 28, consisting of 7 rye and 9 wheat pairs. Its origin was made possible by the lower viability of gametes with additional chromosomes and the tendency for the univalents to be eliminated, exactly as in the case of crosses of hard and soft wheat. It is a balanced hybrid, though not an amphidiploid, and the author considers it perfectly justifiable to regard the hybrid as a new species or even genus. The behaviour of the present hybrids shews that there is no rye genom in the soft wheats and that therefore the view expressed by Meister as to the origin of *T. vulgare* as an amphidiploid from emmer and rye is untenable. The autosyndesis occurring between the two wheat genoms points to their partial homology and is perhaps in agreement with a polyploid view of the origin of the soft wheats.

154. 633.11:575.127.5:633.14:576.356.7

*Lebedeff, V. N. 633.11:576.16:576.356.7

(The phenomena of autosyndesis in the interspecific hybrids of *vulgare* wheat and their significance for the problem of phylogenesis of wheat). U.S.S.R. Narognyi Komissariat Snabženija. Vsesojuznyi N-I Institut Sakharnoi Promyšlennosti (U.S.S.R. National Commissariat for Supplies. All-Union Res. Inst. Sug. Ind.) 1933 : Pp. 35.

In view of the production of a balanced hybrid with 28 chromosomes in an earlier wheat-rye cross (see Abst. 153 above) large numbers of pollinations of this and other Afghan wheats with Petkus rye were made and the F_1 plants again pollinated with rye. Again in the F_2 several plants with 35 chromosomes appeared, together with a number of others with chromosome numbers approaching 35. No case of increased fertility owing to autosyndesis and the loss of the remaining univalents was observed in this case however ; not a single grain was harvested from these plants. The number of bivalents revealed in one of these plants examined cytologically was invariably about 9 or 10, rarely 11. It is assumed that 7 of these are from the rye and the remaining 3–4 bivalents are formed by autosyndesis in the wheat chromosomes. The incomplete autosyndesis of a whole genom accounts for the absence of fertility. The total chromosome number of this plant was 33 but a further plant with 35 chromosomes was examined and revealed the presence of 7 bivalents only, with the remaining 21 chromosomes in the form of univalents. It is clear therefore that the amount of autosyndesis is very different in different hybrid lines. A study was therefore made of the amount of pairing occurring in the F_1 plants. A new F_1 was obtained from the original plant 10423 from which the balanced hybrid was obtained ; some of the F_1 plants shewed a medium amount of pairing, up to 4 bivalents being formed, whilst another group shewed an unusually high amount of pairing, up to 6 and 7 bivalents being observed, with an average of 5·3. This high degree of pairing was not observed in any other F_1 families examined. It is natural therefore to suppose that the autosyndesis observed in the F_2 of this line was directly connected with the high degree of association in the F_1. Moreover, the F_1 frequently displayed complete pairing between many of the partners, not the end-to-end pairing usually associated with wheat-rye hybrids. The course of the whole reduction division was much more nearly normal than is usual in such hybrids and even normal tetrads were frequently found.

In the F_1 plants from another wheat variety the number of bivalents was much lower ; in many cases there was complete absence of bivalents, which never occurred in the fertile F_1 previously described, and the average number of bivalents was 1.8, the maximum observed being 4. The third wheat variety examined shewed no bivalents at all in the F_1 with rye. It is clear therefore that differences in capacity for autosyndesis exist between different lines of *T. vulgare*. This is

* A full summary of this paper is on file at the Bureau.

explained by supposing that in the first place two whole genoms in the species were identical and have only lost their capacity to conjugate during the course of evolution, by differentiation of the chromosomes, a process which has gone further in some varieties than in others. These facts obviously tend to support the view that soft wheat arose by polyploidy, probably in two stages through a tetraploid form, followed by hybridization. The exact means by which these two stages came about remains an open question but there is reason for supposing in the light of the present work, that at least two of the genoms came from the same or nearly related species.

155. Tzitzin, N. 633.11:575.127.5:633.289
(**The question of the method and direction of hybridization**).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1936 : No. 4 : 29–39.

It is pointed out that back-crossing hybrids such as the wheat x *Agropyrum* hybrids to the wheat parent incurs the risk of losing the very characters, such as winter-hardiness, perennial habit, etc., for which the *Agropyrum* parent was chosen. Since a certain number of fertile hybrids occur in this cross it is preferable to cross them among themselves, or even with the sterile forms, to produce the later generations, instead of back-crossing. A description is given of some of the characters which make couch-grass such a dreaded weed and which would be so valuable if introduced into cultivated wheat.

156. 633.11:575.127.5:633.289
Vakar, B. A. 633.11:575.129:633.289
[**A cytological analysis of wheat x couch-grass hybrids. (The self-fertilized forms of the first generation)**].
Sibirskii Naučno-issledovatel'skii Institut zernovogo Khozjaistva (Siberian Grain Res. Inst.), Omsk 1935 : Pp. 31.

Certain of the hybrids obtained by Tzitzin from *Triticum vulgare* x *Agropyrum elongatum* proved remarkably fertile and the present author has examined them cytologically. The *A. elongatum* parent had 70 somatic chromosomes and 35 regular bivalents at meiosis. The somatic number of the hybrid was, as expected, 56 (35 + 21), being thus obtained from the union of two normal gametes. At meiosis 28 bivalents were usually observed, univalents being absent or rare in the first division. This behaviour indicates that in the hybrid concerned the D genom of wheat is homologous with the corresponding (D_1) genom in *Agropyrum*, in addition to the A and B genoms being homologous with A_1 and B_1 as shewn by the presence of 14 bivalents even in the sterile hybrids. In the fertile hybrid moreover, the two remaining *Agropyrum* genoms are evidently paired auto-syndetically and are termed X_1 and X_2. In the progeny of the wheat *lutescens* 062 x *A. elongatum* both fertile and sterile hybrids were found and the difference is thought to be due to the heterozygosity of the *Agropyrum* parent, especially in view of the fact that fertile hybrids with 28 bivalents were also obtained by pollinating certain other wheats with *A. elongatum*, e.g. *albidum* 0604.

Another plant from the cross with *lutescens* 062 contained, in place of 28 bivalents, 21 bivalents and 14 other chromosomes having the appearance of univalents, making a total of 35 ; the 14 univalents may be produced by the failure of autosyndesis between the X_1 and X_2 genoms or by failure of allosyndesis in one or other of the corresponding genoms in the two species.

In another of these fertile hybrids 14 bivalents and 28 univalents were observed.

Even in the hybrid with 28 bivalents a certain amount of lagging was observed at anaphase, the number of lagging chromosomes varying from 7 to 14. Their later behaviour, however, was usually normal and dyad formation was normal, though in some individuals certain of the chromosomes formed irregular masses and were lost. Sometimes wall formation in the second division was omitted and pollen grains were formed directly from the dyads ; apart from this however, no other irregularities of tetrad formation were observed, beyond the presence of occasional micronuclei and small chromatin bodies, and the fresh pollen was perfectly normal in appearance.

An F_2 was obtained from these fertile F_1 plants by self-pollination and these plants were also found to have 56 chromosomes and regular meiosis, apart from a certain amount of lagging at anaphase II and other irregularities similar to those observed in the F_1.

The autosyndesis occurring in the hybrids leads to the conclusion that *A. elongatum* is an amphidiploid species arising from hybridization between two other *Agropyrum* species, one with 42 and the other with 28 chromosomes, the former containing the genoms A_1, D_1 and X_1, the latter B_1 and X_2. One of the parents was probably *A. glaucum* (2n = 42), which with *T. vulgare* gives 14 bivalents and with *T. durum* 7. The hybrids of *T. vulgare* x *A. glaucum* have 42 somatic chromosomes but at meiosis the maximum number of bivalents formed is 14, leaving 14 univalents unpaired, the proposed genomic formula for the hybrid being therefore $AA_1 + DD_1 + B + X_1$. Some unusually fertile F_1 hybrids of this combination were also examined. The number of chromosome bodies observed in metaphase I varied between 28 and 36, from which it is concluded that the number of bivalents varied from 6 to 14 ; the most common number was 10, which was also the case in the sterile hybrids, so that the cause of the fertility evidently does not lie in the number of bivalents formed. Lagging chromosomes were frequent and were often excluded from the daughter nuclei, so that micronuclei and similar bodies were frequently formed. Dyads with unequal chromosome numbers were frequent and in one case a dyad with approximately 42 was observed. Various other irregularities in tetrad formation were observed. The general appearance of the pollen was however mainly good and both pollination and bagging experiments shewed it to be at least partially viable.

The variable number of bivalents in these hybrids shew that the wheat and *Agropyrum* genoms are not identical but only partially homologous. Taking this into account the behaviour of the hybrids conformed with the above assumption that the *A. glaucum* genoms are of the type A_1 D_1 X_1. The affinity of the A_1 and D_1 genoms of *A. elongatum* with the corresponding genoms of *T. vulgare* is evidently greater than in the case of *A. glaucum* but in both cases only bivalents of the ring type were observed, never end-to-end pairing. The fertility of the *T. vulgare* x *A. glaucum* hybrid is attributable to the formation of gametes such as $A_{(a+t)} + D_{(a+t)} + B_t$ or $A_{(a+t)} + D_{(a+t)} + X_1$, $A_{(a+t)} + D_{(a+t)}$, where A_a = *Agropyrum* genom A and A_t = *Triticum* genom A, etc. From the union of such gametes it would be possible to produce in F_2 balanced chromosomal types with 42 and with 28 chromosomes. These 28 chromosome individuals, containing as they do the D genoms characteristic of *T. vulgare*, should resemble this species, though with possible differences owing to the fact that one of the genoms is derived from *Agropyrum* and not from *Triticum*. Similarly, owing to differences between the *Agropyrum* and *Triticum* genoms the 56 chromosome hybrid *T. vulgare* x *A. elongatum*, though balanced chromosomally, will continue to give genetic segregation in the progeny. The presence of genetic segregation in both series of balanced hybrids makes them extraordinarily promising from the point of view of combining the qualities of both species.

157. Favorsky, N. V. 633.11 *Aegilops*: 575.127.5:633.289:576.356
[Reductive division of F_1 hybrids of some *Aegilops* with *Agropyrum intermedium* (preliminary information).]
Socialistic Grain Farming, Saratov 1936 : **6**(1) : 95–101.

In the hybrid *A. speltoides* (n = 7) x *A. intermedium* (syn. *glaucum*) there were observed 7 bivalents and 14 univalents ; the univalents usually divide but sometimes separate irregularly and occasionally fail to divide ; they are also delayed in passing to the poles and dyads with less than 21 chromosomes are occasionally formed, leading also to tetrads with irregular numbers. The young pollen may contain micronuclei and the pollen grains are therefore irregular in size. In *Ae. variabilis* (n = 14) x *A. intermedium* the course of meiosis was similar to the foregoing, 14 bivalents being usually formed ; the pollen irregularities were slightly less pronounced.

Ae. turkmanicum (n = 21) x *A. intermedium* was also very similar in the type of meiosis, the number of bivalents varying from 14 to 21 and the pollen irregularities being still less marked.

In the last hybrid the third pair of genoms are evidently not so nearly homologous as the other two. However, even when all 21 chromosomes form bivalents this does not do away with the irregularities of their separation and of the further course of meiosis. The above results shew that *A. intermedium* (*glaucum*) is genetically and cytologically as close (if not closer), to the genus *Aegilops* as it is to *Triticum*.

158. SIPKOV, T. P. 633.11:575.127.5:633.289:576.356
(A contribution to the cytology of *Agropyrum-Triticum* hybrids).
Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 357–60.

A study was made of the hybrids of *T. durum melanopus* x *A. glaucum*. The F_1 plants were remarkably varied in type, evidently owing to the heterozygosity of the *A. glaucum* parents. The reduction division was very irregular in most hybrids, not more than 2-3 bivalents being formed and dyads and triads being relatively frequent. In certain hybrids, however, meiosis was more regular and 14 bivalents were regularly formed, leaving only 7 of the 21 *Agropyrum* chromosomes unpaired. These are irregularly distributed to the poles, the bivalents separating regularly.
Evidently certain races of *A. glaucum* are much more closely related to *T. durum* than others and so give rise to these fertile hybrids.

159. KATAYAMA, Y. 633.11:575.129:576.354.4
Further investigations on synthesized octoploid *Aegilotricum*.
J. Coll. Agric. Tokyo 1935 : **13** : 397–414.

An account of investigations on *Aegilotricum* forma *fertilis* No. 3, which arose from the cross *Triticum dicoccoides* Körn. var. *Kotschyanum* Perc. x *Aegilops ovata* L.
Fertility and germination are rather reduced in the synthesized *Aegilotricum*, but tend to increase in later generations ; in particular the difference between the fertility of bagged and unbagged spikes decreases. Fertility in back-crosses depends on the species involved and on the direction of the cross, as does germination.
The ratios of pollen grain volume in the three forms were *Ae. ovata* : *T. dicoccoides* : *Aegilotricum* No. 3 = 1·00 : 1·30 : 2·47.
Chromosome pairing in the back-cross forms was in the main such as was to be expected on the hypothesis that the genom of *T. dicoccoides* is AABB, *Ae. ovata* CCEE and *Aegilotricum* AABB CCEE. From 6 to 18 univalents were observed in the cross *Aegilotricum* No. 3 x *Aegilotricum* No. 2 ; since the latter originated from a cross between *Ae. ovata* and *T. durum* it appears that either the A or B genom in the two tetraploid wheat species is not identical.
The frequency of univalents and minor irregularities at meiosis in *Aegilotricum* No. 3 seemed to be greater than in normal species of *Triticum* or *Aegilops*, though there was some evidence that they tended to diminish in later generations.
Occasional variants were found in succeeding generations, including two haploids (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 144) and two monosomics. The absence of pubescence on the rachis in one of the latter and not in the other indicated that different chromosomes had been eliminated in the two cases.

160. LEBEDEFF, V. N. 633.11:575.129:633.14
(The new cases of formation of amphidiploids in wheat rye hybrids).
U.S.S.R. Narodnyi Komissariat Snabženija. Vsesojuznyi N-I Institut Sakharnoi Promyšlennosti. (U.S.S.R. National Commissariat for Supplies. All-Union Res. Inst. Sug. Ind.) 1933 : Pp. 26.

The cross described was between an Afghan variety of *Triticum vulgare suberythrospermum* Vav. and Petkus rye. The hybrid was in every way typical for wheat-rye hybrids, shewed heterosis in respect of tillering but not of ear size, and had a fertility of not more than 0·12 per cent. This F_1 was pollinated with rye pollen and gave rise to an F_2 which was distinctly closer to rye in character than was the F_1. Observations on these F_2 plants in 1930, however, shewed that one of them was very much more fertile than the rest and was at the same time more wheat-like in type. Chromosome counts shewed it to be an amphidiploid with 2n = 56 and in morphological features, which are described, it corresponded very closely to the amphidiploid obtained at Saratov (Cf. " Plant Breeding Abstracts," Vol. I, Abst. 501). It contained 78·4 per cent of good pollen and gave a 38·0 per cent set on selfing.
The average fertility on pollinating the F_1 with rye pollen was, up to 1931, in the neighbourhood of 0·08 per cent ; in that year however certain F_1 plants were observed to be considerably more fertile than the rest, one of them having a fertility 6·73 per cent ; these plants were all found to be descended from one wheat plant. The grain formed by these fertile plants was larger and heavier than the rest, in which respects it actually exceeded both parents, and was of the wheat

type. The seedlings obtained from these grains all, with one exception, contained again 56 somatic chromosomes or approximately that number (53–55).
The origin of such a large proportion of amphidiploids excludes the possibility of their having arisen by self-fertilization, in view of the low fertility of the F_1 plants, and their origin is therefore ascribed to apomixis, evidently stimulated by the pollination with rye. The numbers below 56 are evidently the result of the failure of certain of the chromosomes to divide.
In connexion with the incomplete fertility and chromosome pairing in the amphidiploids it is pointed out that this can hardly be attributed to the incompatibilty of the rye chromosomes and the wheat plasma, since pairing was complete in the 14 chromosome individuals obtained in earlier crosses and containing only rye chromosomes. An explanation based on the incompatibility of the two chromosome sets seems equally untenable, in view of the high fertility of most amphidiploids. The most probable reason for the reduced fertility is thought to be the complete homozygosity of the apomictically developed plants, the phenomena being compared with the depresssion resulting from inbreeding. Just as in the case of inbreeding the effect varies with the different races of the parent plants used. By producing a large number of amphidiploids from different parental combinations fully fertile forms ought therefore to be obtained.
It is further pointed out that, as experience has shewn, the F_1 gametes most nearly approaching the unreduced chromosome number are the most fertile, in which case fertile offspring ought to be produced from them by pollinating with the amphidiploids. This would furnish a means of providing a source of varietal diversity in the amphidiploids. Another suggested means of achieving this is to cross the original wheat strain with other wheats in the hope that it will transmit the tendency to apomixis, whereupon the progeny can be crossed with rye and new amphidiploids be obtained from the different lines. Inter-crossing amphidiploids of different origin affords a further means of providing varietal diversity. By applying these methods it is believed that amphidiploids of agronomic value will be obtained.

161. Masing, R. A. 633.11:575.183
(Xenia in wheat).
Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 47–57.
The length : breadth index of the grain was measured in a number of varieties of soft wheat and their hybrids. With one exception all hybrid grains were of a purely maternal type in this and other characters examined. The one exception was the cross *erythrospermum irkutianum* x Marquis and the reciprocal. Here there was a definite tendency for the hybrids to resemble the paternal form. However, the F_2 grains on the F_1 plants were uniform in character, shewing that the case is not an example of xenia. It is explained by reference to plants of both parental lines emasculated and pollinated by the same variety, in which case the *erythrospermum* parent tended to increase the size of its grains (thus to approach Marquis) and the Marquis parent to reduce them (i.e. to approach *erythrospermum*). This phenomenon gives the effect of a spurious xenia. An examination of the literature on the subject shows that all investigators working with intraspecific crosses have obtained negative results. True xenia in wheat has been observed only in interspecific crosses.

162. Khlop, M. L. 633.11:575.22
(Variation of quantitative characters in spring wheat and its importance in breeding).
Bull. Appl. Bot. Leningrad 1935 : Ser. A (16) : 67–78.
The means, standard deviation and coefficients of variation are given for a number of quantitative characters in hard and soft wheats, namely number of stems, height of plant, length of ear, number of spikelets, number of grains and weight of grains per ear. Among the most variable characters with a variation coefficient of 28·25–38·33 per cent, were number of stems, number of grains per ear and their weight. The lowest variation, with coefficients of 10·60–15·21 per cent was observed in height of plant, length of ear and number of spikelets per ear. These results are in agreement with those of earlier investigators. The results from plants grown in pots agreed with field results, shewing therefore that pot results can be used by breeders to give a preliminary idea of the variation for different characters in breeding material. This will indicate the degree of sensitivity of the lines to changes of environment ; a knowledge of the variability of a particular character is also essential before making selections for that character.

163. Schkwarnikow, P. K. 633.11:575.24:581.01
(The increase of the mutation rate in wheat as a result of prolonged storage of the seed).
Biologičeskii Žurnal (Biologicheskij Zhurnal) 1936 : **5** : 513–20.
Experiments were made with seeds of six varieties of *Triticum vulgare*, *T. durum* and *T. persicum* kept for 10, 9, 8, 7 and 6 years. The seeds mostly shewed reduced germinating capacity, though this was not proportional to the length of time they had been stored, storage conditions evidently having an influence in addition to mere length of time.
The customary anomalies were observed in the plants produced from these seeds, almost all of which were chimaeras of mutant and normal tissue. These plants were all selfed to produce an F_1. The results for two of the varieties of *T. vulgare* are reported. In the first variety 288 mutant plants were observed in an F_1 population of 26,874 plants and in the second variety 192 out of 29,531 plants. The extent to which the chimaeras transmitted their abnormalities seemed to be partially proportional to the length of storage.
The mutants consisted of chlorophyll deficiencies, compactums, squareheads, speltoids, partially and completely sterile individuals, dwarfs, etc., the last three categories having the greatest number. In three cases homozygous speltoids occurred.
The proportion of natural mutants in one of the varieties left untreated as a control amounted to 0·109 per cent, whilst the proportion of mutants in the treated plants varied from 0·6 to 2·4 per cent. No clear relationship could be detected between the precentage of mutation and the time of storage.

164. Sapehin, A. A. 633.11:575.243:537.531
(X-ray mutants in soft wheat).
Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 3–37.
The various abnormalities observed in the first generation seedlings from X-rayed ears of a number of varieties of spring and winter wheat are described and illustrated. The type of anomalies observed was different in different varieties, but all had certain general features in common. The abnormalities consisted of speltoid ears and other ear peculiarities and were usually of a chromosomal nature, fragments and univalents being of frequent occurrence. A direct correlation was observed between the degree of chromosome irregularity and the abnormality of the phenotype, and between the latter and the degree of sterility. The sterility was not so closely correlated with the chromosome irregularity, it being evidently certain particular chromosome elements that are mainly connected with fertility. In the second and third generation seedlings the abnormalities were much less pronounced and the chromosome irregularities had almost ceased.
The changes produced in the winter wheats were somewhat less pronounced than in the spring wheat varieties. One mutant which appeared in the third generation of the variety Kooperatorka was interesting on account of its greater cold resistance than the parent variety, as shewn both by tests in the field and in the laboratory. Artificial mutations are therefore seen to be a possible source of useful new forms in breeding which is especially interesting in the case of vegetatively propagated plants.
In the author's experiments no inverse correlation between chromosome number and mutation frequency such as was reported by Stadler has been observed. The difference may be connected with the much higher doses used in the present experiments. The difference between the present results and those of Delaunay is also ascribed to the different method of treatment, the present plants being treated at the time when mature sex cells were formed, not at the time of the reduction division.

165. Katayama, Y. 633.11:575.243:537.531:576.356
Karyogenetic studies on X-rayed sex cells and their derivatives in *Triticum monococcum*.
J. Coll. Agric. Tokyo 1935 : **13** : 333–62.
Irregularities at meiosis were found to be produced by X-ray treatment of pollen mother cells of *T. monococcum* L., the commonest ones being chromosome fragmentation and chromosome

lagging. Anaphase I in material fixed one hour after treatment was found to be the best stage for estimating the proportions of irregular figures in treated material. It was found that the proportion increased with the intensity and duration of irradiation.
The variants produced in the progeny of X-ray treated plants consisted of miniature plants, a chlorophyll mosaic plant, haploid plants and a semi-sterile plant with slender leaves; in addition frequent cases of low fertility or poor germination occurred.
The mosaic plant had normal and yellow-striped tillers, but shewed no nuclear irregularities. The haploid plants produced an occasional bivalent at meiosis; the haploids occurred not only in the first generation after treatment but also in succeeding generations and their origin is tentatively ascribed to a paucity of functioning pollen and a tendency to parthenogenetic development, induced by X-rays while other environmental conditions also appear to play some part. One of the haploids produced a fertile diploid tiller. The semi-sterile individual had the normal number of chromosomes, 2n = 14, but at metaphase I of meiosis often produced a quadrivalent, indicating the occurrence of translocation.
The genetical significance of X-ray variants is discussed.

166. Schkwarnikow, P. K. 633.11:575.243:581.036.1
Einfluss hoher Temperatur auf die Mutationsrate bei Weizen. (**The influence of high temperature on the mutation rate in wheat**).
Planta 1936 : **25** : 471–80.
Schkwarnikow, P. K.
(**The influence of high temperature on the mutation rate in wheat**).
Biologičeskii Žurnal (Biologicheskij Zhurnal) 1936 : **5** : 503–12.

A brief report on an attempt to alter the mutation rate in a pure line of Kooperatorka winter wheat by the action of high temperature. Only the preliminary data on the F_1 generation are treated.
The exposure of seed for a relatively short time to temperatures of 40 and 60°C. during storage resulted in an increased mutation rate in the progeny of the plants raised from such seed, namely 2·4–8·6 per cent as compared with the 0·05–0·1 per cent recorded for natural conditions. The various anomalies already described (Cf. "Plant Breeding Abstracts," Vol. VI, Abst. 1151) exhibited by young and the fully grown plants from the treated seed are now regarded as secondary phenomena due to inhibitory influences affecting the growth of various portions of organs such as are produced by gross disturbances within the cell. The actual mutations were usually not discernible until the F_1 generation, which comprised 6,793 plants from 165 different families. Of these families 61 shewed mutants that were transmitted to their progeny. Nine types of anomalies were noted including dwarfing, aberrant ear colour and length of awn, speltoids and forms with firm straw of five out of these nine types, one was a dominant mutant occurring in 51 plants and four are regarded as of possible practical value.
Attention is drawn to the potential role of temperature and humidity, etc., as factors affecting the varietal purity of seed during storage.

167. Lepin, T. K. 633.11:575.255:581.46
(**A new case of vegetative chimera in wheat**).
Bull. Appl. Bot. Leningrad 1935 : (1936) : Ser. II (9) : 59–61.

In a study of hybrids between Abyssinian varieties of *Triticum durum* and varieties from other countries a vegetative chimaera for ear pubescence was observed in an F_3 plant from the cross *T. durum abyssinicum* x *T. turgidum* var. *solomonis*; the latter parent was pubescent and the F_3 family was segregating. The plant in question had four ears, one of which was densely pubescent on one side and quite glabrous on the other; all the other ears were pubescent. The ear in question must have been produced by vegetative segregation in the growing point of the ear. Only the epidermal layer was affected, since the progeny of the plant segregated normally into 3 pubescent: 1 smooth.

168. COUTINHO, L. DE AZEVEDO 633.11:576.312.34
Contribuição para o estudo das diferenças nos trigos tetraploides. (**Contribution to the study of the chromosome differences in tetraploid wheats**).
Rev. Agron., Lisboa 1936 : **24** : 113–15.

Observations were made on the chromosomes of *Triticum polonicum* var. *Martinari*, *T. durum* var. *apulicum* and *T. dicoccum* var. *Ajar*. Among the unusual types observed were chromosomes with unduly long constrictions, one chromosome with two constrictions in *T. polonicum*, one with three constrictions in *T. dicoccum*. The unusual types occur in cells side by side with perfectly normal cells and are thought to be of possible cytogenetic significance.

169. MATSUMURA, S. 633.11:576.312.35:581.331.2
(**Chromosome numbers in male germ cells of pentaploid wheat hybrids**).
Jap. J. Genet. 1936 : **12** : 104–06.

Observations at metaphase of the first pollen grain division in hybrids between two-grained *Triticum polonicum* (2n = 28) and *T. Spelta* (2n = 42) shewed that pollen grains with 16, 17 and 18 chromosomes were the most frequently formed and those with 14, 21 and 20 the least frequently formed. When *T. Spelta* and *T. polonicum* were each pollinated by F_1 pollen from *T. polonicum* x *T. Spelta* the percentage set was respectively 94.2 and 72.5.
The somatic chromosome number in *T. polonicum* crossed by the F_1 varied from 28 to 35 and in *T. Spelta* x F_1 from 35 to 42 ; and it made no appreciable difference as regards frequency of functional pollen with the various haploid chromosome numbers (from 14 to 21) whether *Spelta* or *polonicum* was used as the female parent.
Considering the gametes with 14 and with 21 chromosomes, it would seem that in general when the female gamete had a high chromosome number the set was inferior but germination satisfactory, whilst with a high chromosome number in the pollen the set is high but germination percentage low. Pollen grains with 21 chromosomes are calculated as being 12 times more effective in pollination than grains with only 14 chromosomes.

170. AFANASSJEWA, A. S. 633.11:576.312.36:537.531
(**The effect of X-rays on the cell elements of the spring wheat *Triticum vulgare* var. *caesium* 0.III**).
Biologičeskii Žurnal (Biologicheskij Zhurnal) 1936 : **5** : 117–24.

Examination of the untreated parental form disclosed the presence of 3–4 nucleoli in many of the cells ; 42 chromosomes were however always present. The root-tips from seeds subjected to varying doses of X-rays were examined. Those from the lowest doses of 150 and 250 R shewed no difference in chromosome behaviour but a tendency towards polyploidy was evident, expressed both in the occasional presence of polyploid cells and the occurrence of cells with an increased number of nucleoli, 5-6 being often observed. Such cells mostly appeared in groups so that the individuals possessing them were chimaerical in structure. With the higher doses of 1,000 to 16,000 R the formation of micronuclei and other chromosomal irregularities were observed with increasing frequency.

171. KOSTOFF, D. 633.11:576.356.5
Production expérimentale des *Triticum* polyploides. Importance des trihybrides en agriculture. (**The experimental production of polyploid wheats. The importance of trihybrids in agriculture**).
Rev. Bot. Appl. 1936 : **16** : 249–64.

The polyploid forms of *Triticum* experimentally obtained by hybridization with *Aegilops*, *Haynaldia* and *Secale* are briefly reviewed as well as the trihybrid forms containing three distinct genoms.
The cytological origin and the economic value of these polyploids is discussed.

172. 633.11:576.356.5:575.127.5
KOSTOFF, D. 633.11 *T. Timococcum*:575.129
Studies on the polyploid plants. XI. Amphidiploid *Triticum Timopheevi* Zhuk. x *Triticum monococcum* L.
Z. Zücht. 1936 : A **21** : 41–45.

A table is given shewing the results of 33 crosses and back-crosses of *T. Timopheevi* with other species of wheat and with rye and *Haynaldia*. The amphidiploid (2n = 42) here described originated from a cross between the F_1 (*T. Timopheevi* x *T. monococcum*) x an awnless duro-turgidoide No. 80d' $_2$ with 28 2n chromosomes (an F_3 segregate from the triple hybrid *T. turgidum* x *dicoccum* x *vulgare*). Morphologically the plant was identical with the F_1 of *T. Timopheevi* x *T. monococcum* but fertile instead of sterile and probably apomictic in origin.
The amphidiploid, which is to be named *T. Timococcum*, shews a remarkable immunity to the most important fungous diseases of wheat and may prove of great value in breeding work.

173. 633.11:576.356.5:581.036:575.127.5
CAMARA, A. DE SOUSA DA 633.16:576.356.5:581.036
Elementos para o estudo da indução de poliploides no trigo. (**Notes on a study of the induction of polyploids in wheat**).
An. Inst. Sup. Agron. Lisboa 1936 : **7** : 214–33.

Ears of *Triticum monococcum* and *T. turgidum* were subjected to heat treatment at temperatures varying from 48—58°C., certain barley varieties being also treated for comparison. The root tips of the resulting seedlings were examined and were found to contain numbers of polyploid cells, in certain cases whole sectors being present. These were most frequent in the barley, less so in *T. monococcum* and least of all in *T. turgidum*. At the same time a considerable degree of sterility was noted in the treated plants, amounting to about 25 per cent in *T. monococcum*. A great increase was observed in the pubescence of *T. turgidum* and the ears shewed a marked tendency to ramify as in *T. turgidum* var. Mirabile. The size of the ears was much increased also in some of plants and the mitotic activity in the polyploid sectors was exceptionally great. Haploid cells were also frequently observed.
Meiosis displayed certain anomalies, consisting of a tendency of the chromosomes to form closer groups and an increase in the number of chiasmata. Although large numbers of germ cell examinations were made none with the unreduced number were observed.
The author points out that the chromosomal irregularities are insufficient to account for the sterility in many autopolyploids and considers that it must be of a physiological nature ; if certain sterility factors are present in a diploid individual, their effect would be magnified in an autotetraploid obtained from it, hence sterility in varying degrees might be expected, whilst in nature only the most fertile forms will survive, which affords an explanation of the greater sterility of artificial as compared with natural polyploids. The failure to obtain polyploids from the tetraploid wheats is ascribed to similar causes.

174. YEFEIKIN, A. K. and VASILYEV, B. I. 633.11:576.356.52:537.531
(**Artificial induction of haploid *durum* wheats by pollination with X-rayed pollen**).
Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 39–45.

Large numbers of pollinations were made with X-rayed pollen on emasculated ears of the same variety from which the pollen was taken. Dosages of 2,200 and 2,500 R were given ; the latter gave a lower percentage of viable seeds than the former.
From plants of *T. dicoccum* and *T. persicum* certain unusual plants were obtained which shewed a marked resemblance to each other and to *T. monococcum*, having for instance pubescent stem nodes as in that species. Both these plants proved to be haploid, with 14 somatic chromosomes. The ear of the *T. persicum* haploid was shorter and denser than in the parent species and the empty glume tooth was shorter ; the *T. dicoccum* haploid also resembled *T. monococcum* greatly in the ear. Certain features, such as the colour, characteristic of the parent species, developed in both haploids towards the time of maturity. Both were entirely sterile, and the *T. dicoccum* haploid was more brittle even than the parent species.

The appearance of the pubescent nodes in the haploids is curious since in crosses of these species with *T. monococcum* this character is dominant.
The ease with which haploids can be obtained by this method makes it possible to consider a detailed genetical and cytological analysis of the different wheat species on the basis of their haploids.

175. Nikolaenko, E. I. 633.11:581.142:581.48:575.1
(Sprouting of the grain in spring and winter wheats of the world collection at Detskoe Selo).
Bull. Appl. Bot. Leningrad 1935 : Ser. A (16) : 55–58.
Observations on large numbers of wheat varieties have not confirmed the view that white varieties are more prone to sprouting than red wheats. The wheats found to be most subject to sprouting are those which have a very short period from earing to maturity and at the same time are highly susceptible to *Fusarium rostratum*. These are mostly wheats from southern countries with a short growing season and dry summers. The varieties least prone to sprouting have also been found to be resistant to *F. rostratum*. Certain varieties of this type from Russia, Sweden, Finland, India and the U.S.A. are enumerated. In addition to these most of the wild wheat species are included in the resistant group.
Segregation in both directions was observed in F_2 hybrids between Russian wheats and varieties from Western Europe.

176. Matzkov, F. F. 633.11–2.112–1.521.6:578.081
(The physiological characteristics of the varieties of spring wheat).
Sovetskaja Botanika (Soviet Botany) 1936 : No. 1 : 98–105.
A small apparatus is described whereby leaves of a variety can be subjected to a graded series of temperatures and the lethal temperature so determined. This lethal temperature differs for different varieties and is a useful factor in estimating the drought resistance for breeding purposes.

177. Grumm-Gržimailo, A. G. 633.11–2.451.3–1.521.6
(New varieties of wheat resistant to flag smut from China).
Bull. Appl. Bot. Leningrad 1936 : Ser. A (18) : 147–48.
Reference is made to a Chinese variety Nanking No. 716 and the Australian variety Nebawa, both of which have proved highly resistant to *Urocystis tritici*.

178. 633.11–2.451.3–1.521.6:575(79.2)
Tingey, D. C. and Woodward, R. W. 633.11 Relief
Relief wheat.
Bull. Utah Agric. Exp. Sta. 1935 : No. 264 : Pp. 12.
Selected from a cross between Hussar and Turkey 26, the new variety combines the resistance to covered smut of the former with the yield, quality, habit of growth and date of maturity of the latter. It was bred by the Department of Agronomy of the Utah Agricultural Experiment Station. Data are given to illustrate its resistance and high yield in various tests. Though it is resistant to most of the prevalent forms of covered smut or bunt (*Tilletia tritici* and *T. levis*) it is susceptibe to two forms. Further strains of wheat have now been developed at the Utah Agricultural Experiment Station which are highly resistant to all the forms of covered smut prevalent in the region.

179. Nieves, R. 633.11–2.451.3–1.521.6:575.11
Genética de la resistencia a la " carie " (*Tilletia tritici* raza 5 M.A.), en la cruza Barletta x Florence (Cheg 27–10x). [**Genetics of resistance to smut, (*T. tritici* line 5 M.A.), in the cross Barletta x Florence (Cheg 27 10x).**]
Noticias Agric., Min. Agric. Nac., Direcc. Gen. Agric., Div. Estac. Exp. Secc. Fitotecn., B. Aires 1935 : **2** (4) : Pp. 15.
Physis B. Aires 1936 : **12** : 51–63.
The cross of Barletta x Florence was made in 1927. A certain amount of variation in morphological characters was obtained in the F_1 generation, evidently owing to a certain amount of impurity

in the Barletta parent. The F_2 was also very variable and 7 of the families segregated normal and dwarfs in the ratio 13 : 3. The F_1 was almost as badly infected by smut as the Barletta parent, and in F_2 there were infected and free in the proportion 1.414 : 1·544. In F_3 282 plants were grown and shewed all degrees of infection varying from 0 to 97·5 per cent. It is concluded that at least two factor pairs and probably various modifying factors are involved.
No correlation was observed between resistance and any of the morphological factors or of resistance with earliness.
The unduly high variation that was observed in the variety Florence is taken as an indication of racial heterogeneity either in this variety or the parasite or in both.

180. 633.11–2.451.3–1.521.6:575.11
SMITH, W. K. 633.11–2.451.3–1.521.6:581.036
The inheritance of resistance to physiologic forms of *Tilletia levis* and *T. tritici*, and the effect of temperature on pathogenicity.
Res. Stud. St. Coll. Wash. 1935 : **3** : 29–30.
A brief account of work previously described (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 394). The resistance of Hope is lost at low temperatures, while the susceptibility of Jenkin is unaffected by temperature.

181. KÜDERLING, O. -E. 633.11–2.452 *P. glumarum* :631.521.6:581.08
Untersuchungen über die Feldresistenz einzelner Weizensorten gegen *Puccinia glumarum tritici*. (**Investigations on the field resistance of individual wheat varieties to *P. glumarum tritici*).**
Z. Zücht. 1936 : A **21** : 1–40.
In these two-year experiments the nature of field resistance is analysed with special attention to the part played by temperature and the stage of development of the plant. Seventeen varieties of wheat, both spring and winter, were used and six races of *Puccinia glumarum tritici*. In the temperature experiments in the greenhouse fifteen varieties and five races of yellow rust were used and the plants were kept at six different temperatures.
The results shew that three different varietal groups are to be distinguished, one which tends at the lowest temperature to be most attacked, another which behaves conversely and a third which appears to be indifferent to the temperature. The races of the fungus also behave differently under the various temperatures and differences in field resistance are dependent on temperature.
Three winter and three spring wheats were used and three races of the fungus in the experiments on the effect of developmental stages at different temperatures. The winter wheat was vernalized in the 1933 experiments. There were considerable differences in the reactions in the first three stages in the two years ; in the fourth and last stages there was no infection as the plants were too old.
The varieties Ridit and Blé Aurore were only attacked in the seedling stage and were otherwise resistant to two of the races of rust but susceptible in all three stages to the third form.Temperature made very little difference.
Garnet behaved in a similar way but was resistant to all three forms in the later stages.
Hörnings Dickkopf and Normandie were susceptible throughout but attacks were most severe at low tempratures. Carsten V was attacked throughout by one race and neither temperature nor age altered the attack. To another race it was resistant in certain stages but more susceptible at high temperatures. To the third race it became increasingly resistant as the age of the plant increased but the attack was worst at low temperatures.
The plants were then examined in the field for their behaviour during rust attack to temperature and stage of development and the differences encountered make it clear that both field infection and infection in the greenhouse must be studied to elucidate the relation between them in any definite variety.

182. Anderson, D. C. and Brown, H. M. 633.11–2.7–1.521.6
Studies on Hessian fly infestation and some characters of the wheat culm.
J. Amer. Soc. Agron. 1936 : **28** : 479–83.
Significant differences between strains of wheat in 1932 and 1933 were observed in respect of infestation by Hessian fly (*Phytophaga destructor* Say), breaking strength of culm, weight of culm and diameter of culm. The correlations between percentage infestation and the other three characters, however, were not significant.

183. Cartwright, W. B. and Wiebe, G. A. 633.11–2.7–1.521.6:575.11
Inheritance of resistance to the Hessian fly in the wheat crosses Dawson x Poso and Dawson x Big Club.
J. Agric. Res. 1936 : **52** : 691–95.
The crosses were part of a breeding programme aiming at the production of club wheats combining the desirable qualities of Big Club and Poso with the resistance of Dawson to Hessian fly, *Phytophaga destructor* Say. Classifying the F_2 on the basis of the F_3 behaviour and assuming 7·5 per cent. to be the minimum infection of susceptible lines, a segregation into 15 resistant : 1 susceptible was obtained, shewing that two factors are probably involved.
The fundamenal nature of the resistance is not known, but it was observed that on resistant plants the newly hatched larvae die shortly after reaching their feeding position between the leaf sheath and culm.

184. Noachovitch, G. 633.11:664.641.016
Rapport sur les problèmes que pose l'appréciation de la qualité des blés tendres. (**Report on the problems raised by a consideration of the quality of soft wheats**).
Sélectionneur 1936 : **5** : Fasc. 1 : 16–24.
As a result of a discussion on the present significance of the term " baking quality " which is now taken to cover not only the technical problems but the genetical and others as well, it is proposed that the qualities of wheat as a commercial product should be classified under the following four groups of essential characteristics ; physical-biochemical indices, tasting value, nutritive value and dietetic value. Besides these four groups the agricultural value must not be lost sight of.

185. Klemt, G. and Schmidt, E. A. 633.11:664.641.016(43)
Die weiteren Untersuchungen auf Kleberweizen an der Versuchsanstalt für Getreideverarbeitung in Berlin. (**The further investigations of high gluten wheats at the experiment station for work on cereal in Berlin**).
Z. ges. Getreidew. 1936 : **23** : 89–92.
The results of the further tests of German bread wheats (Cf. " Plant Breeding Abstracts," Vol. VI, Abst. 1228) up to 31st March, 1936 are given. Grossherzog von Sachsen and Siegerländer were the best winter varieties and of the spring wheats Janetzki was again a good first.

186. Lindschau, M. and Oehler, E. 633.11 *Aegilops*: 576.312.32:575.127.2
Cytologische Untersuchungen an tetraploiden *Aegilops*-Artbastarden. (**Cytological investigations on tetraploid species hybrids of *Aegilops***).
Züchter 1936 : **8** : 113–17.
Six crosses were made. In *Ae. Kotschyi* x *Ae. variabilis* the regularity of the reduction division shewed that these two species possess two completely homologous genoms. *Ae. variabilis* x *Ae. triuncialis* were found to have one pair each of semi-homologous genoms and it is assumed that this is the C genom identified by Kihara. If out of the 12 bivalents present 7 are assumed to represent the union of the C genom, the remaining 5 must represent the union of the T genom of *triuncialis* with the second *variabilis* genom.
In *Ae. triuncialis* x *Ae. columnaris* there is a similar pair of semi-homologous genoms also assumed to be the C genom. The remaining bivalents 2-3 represent the union of the other, not yet identified genoms.

In *Ae. triaristata* x *Ae. triuncialis* the bivalents vary from 0–9 and it is assumed that each parent possesses one related genom which, however, has undergone very considerable differentiation. *Ae. triaristata* x *Ae. cylindrica* have each a pair of semi-homologous genoms, whose affinity, to judge from the number of ring-shaped bivalents, is not very great. *Ae. triuncialis* x *Ae. cylindrica* shewed 0–10 bivalents, 4-7 being most frequent and it appears probable that these two species have a pair of semi-homologous genoms with only a very slight affinity and it is assumed that both are the C genom.
The results confirm the suggestion of Kihara and Lilienfeld that other tetraploid species of *Aegilops* besides *triuncialis, ventricosa, ovata* and *cylindrica* possess a C genom.

OATS 633.13

187. Hayes, H. K., Wilson, H. K. and Crim, R. F. 633.13:575(77.6,
Oats in Minnesota.
Sp. Bull. Minn. Agric. Ext. Div. 1935 : No. 165 : Pp. 8.
Brief accounts are given of varieties of oats suited to the different parts of Minnesota, including some of the rust-resistant, stiff-strawed, high-yielding varieties developed at the Minnesota Agricultural Experiment Station.

188. Nishiyama, I. 633.13:576.356.5:575.127.2:576.354.46
Cytogenetical studies in *Avena*. I. Chromosome association in hybrids between *Avena barbata* Pott. and autotetraploids of *A. strigosa* Schreb.
Cytologia, Tokyo 1936 : **7** : 276–81.
Crosses were made between an autotetraploid with the genom formula AAAA and *Avena barbata* with the genom formula AAB′B′ and chromosome pairing was studied at the first metaphase of meiosis in the hybrid. In addition to trivalents, bivalents and univalents, from one to four quadrivalents and even one quinquevalent were found. Chiasma frequencies in the three forms are also recorded.
To explain the high degree of association found in the hybrid it is necessary to postulate partial homology between certain chromosomes of the A and B′ genoms. These relations are illustrated in diagrammatic form.

189. Murphy, H. C., 633.13–2.451.2–1.521.6:575
Stanton, T. R. and Coffman, F. A. 633.13–2.452–1.521.6:575
Hybrid selections of oats resistant to smuts and rusts.
J. Amer. Soc. Agron. 1936 : **28** : 370–73.
From crosses of the crown rust and smut (loose and covered) resistant oat Bond with the stem rust-resistant varieties Iogold, Anthony, Iowa No. D69 and No. 444 and Green Russian selection, lines have been developed shewing outstanding resistance to the physiological forms of the rusts and smuts prevailing in the corn belt region. The selections have yet to be tested for yield and adaptation.

190. Austin, W. W. and Robertson, D. W. 633.13–2.451.2–1.521.6:575.11
Inheritance of resistance to *Ustilago levis* (K and S) Magn. (covered smut) in a cross between Markton and Colorado 37 oats.
J. Amer. Soc. Agron. 1936 : **28** : 467–71.
Markton is resistant to the inoculum of *U. levis* used and Colorado 37 is susceptible. Based on the F_3 data, a distribution of 9 resistant : 7 susceptible was obtained in the F_2 of the cross Colorado 37 x Markton, indicating the presence of two dominant factors for resistance in Markton. Some of the highly resistant lines are being continued in the hope of developing high-yielding, smut-resistant commercial strains.

RYE 633.14

191. 633.14:575.14:576.356:576.354.46
633.14:576.356.5

LAMM, R.

Cytological studies on inbred rye.

Hereditas, Lund 1936 : **22** : 217–40.

Meiosis in inbred lines of rye was compared with that in plants of an ordinary population, with a view to studying the cytological effects of inbreeding.

Chiasma frequencies tended to be lower in the inbred lines than in the population. In some cases they were much lower and this was often though not always, accompanied by less contraction of the chromosomes. In some plants univalents occurred and it could be ascertained that these were not always the same chromosomes.

Terminalization, expressed as a percentage of the maximum possible for the different types of bivalents, was higher in inbred plants and increased as the mean chiasma frequency per cell decreased, though it was highest in the bivalents with most chiasmata.

Negative correlations between the chiasma frequencies of bivalents (See Abst. 10) occurred less often in inbred lines than in the population.

Different types of disturbance of meiosis were observed in the inbred plants. The univalents produced as a result of reduced pairing often shewed non-disjunction. If included in the first metaphase plate they divided at the first anaphase and lagged at the second, later forming micronuclei and sometimes microcytes. Chromatin bridges, probably indicating the presence of inversions, were observed at first anaphase. A group of pollen mother cells with the double number of chromosomes was seen and giant and dyad pollen grains were also noted.

It is considered that the extra chromosome in eight-chromosome rye is more likely to have arisen through structural hybridity, non-disjunction or fragmentation than by transverse segmentation at the attachment constriction.

MAIZE 633.15

192. 633.15:575.12
633.15.00.14(77.3)

DUNGAN, G. H., HOLBERT, J. R. and LANG, A. L.

Progress in hybrid corn production.

Illinois Fmrs' Inst. 1935–36 : Pp. 43.

After a description of the production of hybrid maize seed an account is given of tests of different hybrid lines in different parts of Illinois, in comparison with open-pollinated varieties.

Other topics connected with hybrid maize are treated, in particular its ability to utilize plant nutrients in the soil.

193. LORA, A. 633.15:575.42

Selección de maíz para semilla. (**Selection of maize for seed**).

Rev. Agric. Habana 1936 : **19** : 12–24.

In the form of a dialogue between two neighbours, full instructions are given for selecting the best plants and best cobs for seed, for storing them and germinating the seed preparatory to sowing.

194. SPRAGUE, G. F. 633.15:581.142:575

The relation of moisture content and time of harvest to germination of immature corn.

J. Amer. Soc. Agron. 1936 : **28** : 472–78.

Reduction of the moisture content of immature grains of maize increased their germination percentage and reduced their variability in time of germination. Since the moisture content must be increased again before germination can actually occur, it is argued that an irreversible change must take place during drying. Evidence is presented from a case of hetero-fertilization that the change is genetically controlled and that it is the genotype of the scutellum which is important in this respect.

195. 633.15:581.162.3:578.08

Métodos de autopolinización y cruces en el maiz. (**Methods of self-pollination and crossing in maize**).

Rev. Agric. Habana 1936 : **18** : (4) : 129–37.

A popular description is given of the various methods of artificial self and cross-pollination in maize.

196. TAVČAR, A. 633.15:581.48.061.6:575.116.1

Beitrag zur Vererbungsart der Spindelfärbung an vierkornreihigen Maiskolben. (**A contribution to the mode of inheritance of the rachis colour in four-rowed maize cobs**).

Z. indukt. Abstamm. -u. VererbLehre, 1936 : **71** : 341–52.

In the four-rowed maize cobs already described by the author (see " Plant Breeding Abstracts," Vol. VI, Abst. 542) the rows of grains are arranged in pairs on the two opposite sides of the rachis, so that on the other two sides the bare and smooth rachis can be seen. The rachis colour was found to be either white or red and was monofactorially inherited and homozygous forms were obtained. By means of various crosses a number of different colour combinations of glumes, pericarp, rachis and endosperm were procured.

Back-crosses made to investigate the relation of the rachis colour to the pericarp and glume colour shewed that only the parental phenotype was reproduced, the recombinations never occurred. The gene for rachis colour *Rh rh* must therefore be closely linked with the genes for pericarp and glume colour.

A close linkage must also be assumed for the allelomorphic genes for pericarp colour and those for glume colour.

197. KOŽUKHOV I. V. 633.15–1.524.4:575

(**Results of investigation of the world varietal resources of maize**).

Bull. Appl. Bot. Leningrad 1935 : Ser. A (16) : 5–18.

All the maize grown in the U.S.S.R. belongs to the group *indurata* and the varietal diversity is extremely limited. A great wealth of valuable material and characters, however, has been found by studying the world resources of the maize crop ; e.g. the Bolivian varieties remain green long after the grain matures, which suggests the possibility of using them both for grain and silage, the forms from Southern Mexico have hard sheaths surrounding the cob and protecting it from insects, those from Peru exceptionally large grain and tender cob axis ; unusually early forms have been brought from Canada, Western China and certain Western European countries, the latter forms having the advantage of bearing their cobs higher up the stem than most early forms. Resistance to the corn borer has been found in varieties from Western Europe (Amargo and many others since discovered), resistance to drought in Arizona and New Mexico and in the Central Asiatic Republics of the U.S.S.R. These investigations have shewn that the different groups have their centres of diversity in different places, the *indurata* group in Central America and Colombia, the *indentata* group in Central and Southern Mexico and the *amylacea* group in Peru. Some of the recessive forms occurring far away from these centres are economically also very valuable, as the Eastern Asiatic forms with waxy endosperm, the early forms of Canada etc. Marked geographical variations have been observed in content of protein, starch and oil and also in size of starch grains, which varies from 2–30 microns. Pop-corn types are unknown in the primary centres of distribution, i.e. S.E. Mexico and Central America, and the flint forms characteristic of these regions are regarded as the oldest, original forms. The forms occurring in the mountains of Mexico, though containing starchy, dent and flint varieties, are all of a particular ecological type only capable of growing in semi-arid, non-irrigated areas ; they are all characterized by marked pubescence of the leaf sheath, superficial root system, reduced number of lateral branches of the tassel, soft leaf surface, a tendency to lodging and a long period, up to two weeks and more, between the flowering of the male and female inflorescences. This group is separated into a distinct subspecies *montano-mexicana* and three other subspecies are also established on similar grounds, namely *tropica*, *arizonica* and *peruviana* ; *tropica* is

the oldest and has under the influence of climatic changes and cultivation become differentiated into a number of *proles*.

The separation of maize into these ecologically and geographically distinct groups greatly facilitates the task of the breeder. A table is given indicating the different subspecies and *proles* in which certain important characters are to be found.

The full wealth of characters existing in maize will only be revealed when the various subspecies and groups are crossed one with the other, whereby many new characters may be revealed and the genetics of the existing ones made clear. For northern conditions the most interesting are the Arizona, Central Asiatic and far Eastern groups, characterized by the greatest drought and cold resistance. The problem of vegetation period is also very important in this connexion, especially the photoperiod and the relative lengths of the different developmental phases.

198. Doxtator, C. W. and Johnson, I. J. 633.15–1.557:575.125
Prediction of double cross yields in corn.
J. Amer. Soc. Agron. 1936 : **28** : 460–62.

It was found that significant differences in the double cross yields from four given inbred lines were obtained by using different single crosses as parents and moreover that the predicted yields of double crosses (the average of the yields of the four single crosses not used as parents) gave a good agreement with the actual yields.

The predicted yields of three-way crosses, based on the average yield obtained from the two single crosses between the two inbred lines used in the single cross and the inbred line used as the male parent in the three-way cross, also gave good agreement with the actual yields of the best double crosses involving the same four inbred lines.

199. Ranninger, R. and Lerner, E. 633.15–2.451.2–1.521.6:581.192
Saugkraft und Brandanfälligkeit beim Mais. (**Osmotic pressure and smut susceptibility in maize**).
Landeskultur 1935 : **2** (10) : 187–88.

The Weigelsdorf Agricultural School in Lower Austria is engaged in breeding a type of maize suitable for ensilage in a dry climate, selection being based on tests of the osmotic pressure of the seed. It was found that plants with a high osmotic pressure grew particularly well even with unfavourable weather but they also proved more susceptible to smut than plants with lower osmotic pressure ; figures are cited in which the ratio of infection is as 3 : 1. This difference in the incidence of the disease among the plants was maintained even when seed of different osmotic pressures from the same ear was taken.

In future breeding work most careful selection of plant material completely free from smut and strict elimination of any infected individuals that happen to appear in the plots are to be carried out.

The relation between greater incidence of infection and high osmotic pressure may, it is suggested, be possibly due to the more rapid and luxuriant growth, the larger stem and leaf development, more porous tissues and finally to greater susceptibility due to inbreeding such as occurs in animals.

200. 633.15–2.7–1.521.6:575.12(77.4)
Marston, A. R. 633.15 Michigan Hybrid No. 561
Michigan Hybrid No. 561 a borer-resistant field corn.
Quart. Bull. Mich. Agric. Exp. Sta. 1936 : **18** : 223–25.

Hybrid No. 561 is a top-cross between the synthetic variety S-10 and an inbred line, the synthetic variety having been produced by blending 91 inbred lines. Both parents possess resistance to European corn-borer, derived from the South American variety Amargo. The new hybrid is suited to the southern parts of Michigan and similar dent hybrids are being developed for the northern parts.

201. 633.16 Puke II

Berg, S. O. 633.16:575.12(48.5)

Weibulls Pukekorn II. Ny, mycket tidig tvåradig sort med ypperlig stråstyrka, hög avkastning och utmärkt kärnkvalitet. (**Weibulls Puke barley II. A new very early two-rowed variety with excellent standing capacity, high yield and first rate grain quality**).

Weibulls Ill. Årsb. 1936 : **31** : 25–28.

A description of the new barley Puke II from the cross Puke x the Danish variety Binder. It yields as well as the six-rowed Vega and has a higher hectolitre weight. Also it has shorter, stiffer straw, ripens a day earlier than Puke and three days later than Vega.

202. 633.16(77.5)

Leith, B. D., Shands, H. L. and Moore, R. A. 633.16:575

Quality barley—how to grow—how to handle.

Circ. Wis. Coll. Agric. Ext. Serv. 1936 : No. 278 : Pp. 30.

After instructions on the growing of barley, a brief account is given of the methods of breeding improved varieties and descriptions of the more popular varieties grown in Wisconsin. The diseases of barley and other topics are also briefly treated.

203. 633.16:551.566.3:575

Bakhteev, F. Kh. 633.16:581.162.32

(**The work and prospects of breeding barley within the Arctic Circle**).

Bull. Appl. Bot. Leningrad 1936 : Ser. A (18) : 39–41.

The entire world collection of barleys has been tested at the polar research station at Khibiny and the varieties distinguished by the earliest maturity are mentioned. The varieties produced by the station were in many ways the best but further improvement in earliness and in resistance to frost, if it occurs at the time of ripening, is required. Further crosses are being made on Lysenko's principle of the choice of varieties.

Plants of aberrant type have appeared regularly in a number of pure lines of different barley varieties. The characters affected have been awn or spikelet characters and segregation has occurred on breeding from them. The appearance of six-rowed among two-rowed forms and of deformed awns were frequent manifestations and the author is of the opinion that the phenomenon is due to out-pollination but it is to be subjected to further investigation.

204. Wang, S. 633.16:575.11

(**Inheritance in barley**).

J. Agric. Ass. China 1936 : No. 148 : 1–16.

Monohybrid segregation was observed for the following character pairs, the dominant character being the first mentioned in each case : lax vs. compact spike, hooded vs. awned, covered vs. naked grain, rough vs. smooth awns, less than six-rowed vs. six-rowed spike and strong awn vs. weak awn.

A good fit to a 9 : 3 : 3 : 1 ratio was obtained with covering of grain and awned condition, covering of grain and smoothness of awns, smoothness of awns and number of rows per spike and in two of four crosses involving covering of grain and number of rows per spike ; in the other two of these four crosses and in a cross involving density of spike and strength of awns the fit was not so good, but it is not believed that this is due to linkage.

205. Tokhtuyev, A. V. 633.16:575.11.061.634

(**Albinism in barley**).

Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 307–09.

A variety of *Hordeum distichum erectum* from the Urals was found be be segregating albinos in a monohybrid ratio. This ratio was confirmed by an examination of the second generation from the surviving plants, the albinos themselves having all died at an early stage.

206. Powers, L. 633.16:575.113.5:575.125

The nature of the interaction of genes affecting four quantitative characters in a cross between *Hordeum deficiens* and *Hordeum vulgare*.

Genetics 1936 : **21** : 398–420.

The lines used in the cross were termed B 1 and Brachytic respectively ; B 1 had black glumes, *deficiens* type of spike and normal growth (*BBVVBrBr*) while Brachytic had white glumes, *vulgare* type of spike and brachytic growth (*bbvvbrbr*). The object of the study was to investigate the effect of these genes and any which might closely be linked with them on the quantitative characters, yield of grain per plant, number of spikes per plant, height of plant and length of awn and especially the interaction of the genes. Measurements of the quantitative characters were made on F_2 plants whose genotype was determined with the aid of F_3 families. A statistical method involving the analysis of variance and of covariance was used in reducing the data. The three qualitative characters were inherited independently.

In the case of the genes associated with colour of glumes higher values for all four quantitative characters were obtained from *Bb* plants than from *BB* or *bb* plants, an effect which can be explained as due to heterosis.

The effect of genes associated with type of spike and habit of growth was much more complicated. Thus *vv* plants gave a greater yield of grain than *Vv* plants, which in turn yielded more than *VV* plants ; this was true whether the constitution of the plants with respect to habit of growth was *BrBr*, *Brbr* or *brbr*. Again the *BrBr* and *Brbr* segregates exceeded the *brbr* plants in respect of all four quantitative characters in the *VV*, *Vv* and *vv* plants. In many cases, however, interactions between the factors were such as to preclude the clear statement of general trends. These interactions were studied, their significance being determined by statistical methods. Though no general rule could be drawn, it was found that there was a general tendency for favourable genes to give greater increases over their allelomorphs when in combination with other favourable genes than they did in combination with less favourable genes. It is pointed out that this does not agree with Rasmusson's hypothesis (Cf. " Plant Breeding Abstracts " Vol. IV, Abst. 76).

The variances of different genotypes were found to be different, those having the larger means having larger variances. Furthermore different genotypes with approximately similar means had also different variances.

It was also found that under favourable environmental conditions favourable genes produced greater increases in yield of grain over unfavourable genes than they did under unfavourable environmental conditions.

The results are discussed in relation to East's classification of genes into physiologically defective and non-defective (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 446) and it is pointed out that they support his hypothesis which is considered to be of value to plant breeders.

207. Miège, É. 633.16:575.22:581.02

L'influence du milieu sur la stabilité des espèces élémentaires d'*Hordeum*. (**The effect of environment on the stability of the elementary species of *Hordeum*).**

Ann. Sci. Nat. Bot. 1936 : Sér. 10 : **18** : Fasc. 1 : 106–09.

The extensive data obtained at Morocco on the variation produced in elementary species of barley by environmental conditions (Cf. " Plant Breeding Abstracts," Vol. VI, Abst. 894.) are here confirmed by similar data on pure lines grown at high and low altitudes.

The principle of the immutability of species need not however be affected by these observations since the lines studied—though stable in their country of origin—are regarded as probably descended from unsuspected hybrid ancestors and therefore subject under new conditions to segregation.

208. 633.16:575.242

Tokhtuyev, A. V. 633.16:575.11:581.46

(A new mutation in barley—absence of waxy bloom on the leaves).

Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 361–66.

An ancient local barley from the locality of Perm, *Hordeum vulgare pallidum* Ser., gave certain plants free from wax on the leaves, though the stems and ears were normally glaucous. The

form appears to be hitherto unknown. In crosses with the normal the new mutant gave monohybrid segregation.
The waxless forms proved to be less susceptible to *Puccinia glumarum* ; for this reason it was crossed with a variety D.S. 1587 *H. medicum* Körn. In this cross again wax was dominant in F_1 and in F_2 segregation occurred for this character and for smooth awns, long bristles and fertility of lateral spikelets, 3 : 1 ratios being again obtained for waxiness ; this was confirmed in the F_3. No linkage was observed between the waxy gene and the other characters mentioned above.

209. Berg, K. H. von 633.16:576.356.5
Autotetraploidie bei *Hordeum bulbosum* L. (**Autotetraploidy in *H. bulbosum* L.**)
Züchter 1936 : **8** : 151–58.

A cytological examination of the reduction division of *H. bulbosum*, which has the somatic chromosome number of 28, shewed that there might be a maximum of 7 quadrivalents, 4—5 being most frequent with the appropriate number of tri-, bi- and univalents. The polyvalents were most frequently in the form of a ring and the chiasmata were mainly terminal.
Other material examined which had been fixed during a cold period shewed a decrease in chiasma frequency and as a result a large number of univalents. The normal material, however, shews that *H. bulbosum* possesses four equal homologous genoms or, in other words, is autotetraploid. The importance of this in relation to the origin and genetics of *H. bulbosum* is discussed.

210. Bakhteyev, F. Kh. 633.16:581.143.26.035.1:581.9
(Geographical variation of the length of the vegetation period in various barley types).
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Var. Testing Service 1935 : Pp. 40.

Extensive observations were made on the whole world collection of barley varieties grown at a number of distinct points in the Soviet Union. Marked varietal differences were detected in the length of the period germination to earing and in the type of response to relatively high temperature and long day, which favour this particular phase. The varieties are arranged into eight groups according to their reaction. The time required for this phase varied from 28 to 86 days and more in different varieties, certain of the groups being particularly promising for breeding for northern forms.
Similar differences were observed in the length of the phase earing to maturity ; this phase varied from 10 to 64 days, the most valuable for breeding for the north being the group of varieties capable of ripening in a relatively short time at low temperatures (15 17°C.) and high humidity (over 150–200 mm. rainfall). For the south such rapidly maturing forms are of little use, since under the dry conditions of the south they are unable to fill the grain in such a short period. For such regions the forms capable of ripening under conditions of high temperature and drought are the most valuable and these most often prove to be comparatively late forms. It is essential in breeding to be thoroughly familiar with the neighbourhood for which the varieties are designed so as to know in which of these two stages earliness is required ; for some regions rapidity in one stage is necessary, for other regions rapidity in the other and for certain regions rapidity in both is essential in order to get a successful yield.

211. Roemer, T. 633.16:581.46:575
Nacktgerste. (**Naked barley**).
Mitt. Landw. Mannheim 1935 : No. 51 : Pp. 2.

Attention is drawn to the advantage of breeding a naked barley from the standpoint of both the increased nutritive value of such a crop for stock feeding and also its increased resistance to lodging. For the production of naked barleys the primitive naked forms—extant in the Tirol and the Alps as well as in Nepal and other Asiatic regions—could be crossed with high yielding hulled barleys. Experiments demonstrating the relative fodder value of naked and hulled barleys are reported. The naked type would be unsuited for brewing purposes.

MILLETS AND SORGHUMS 633.17

212. KARPER, R. E. and CHISHOLM, A. T. 633.174:576.312.35
Chromosome numbers in sorghum.
Amer. J. Bot. 1936 : **23** : 369–74.

The meiotic and somatic chromosome number was determined for 28 varieties and strains of grain sorghum, sorgo and broomcorn, all of which belong to the species *Sorghum vulgare* Pers.; and the haploid and diploid numbers in this species were found to be 10 and 20 respectively. The same haploid number was also found in determinations made with *S. sudanensis*, *S. virgatum* (Hack.) Stapf, *S. verticilliflorum* (Stead) Stapf, *S. drummondii* (Nees) Hack., *S. hewisoni* (Piper) and *S. effusus* Hack., all of African origin.

Sorghum halepensis, a perennial form native to Africa and Asia and *S. h. miliformis* (Schultes), a perennial form from India had 2n = 40. The F_1 hybrid from *S. vulgare* x *S. halepensis* had 30 chromosomes in the root tips and in pollen mother cells all associations up to quadrivalents were observed, the most usual complement being $7_I + 8_{II} + 1_{III} + 1_{IV}$, (Cf. "Plant Breeding Abstracts," Vol. IV, Abst. 855).

S. versicola from Africa had n = 5 and 2n = 10 while in the related perennial grass *Andropogon annulatus* Forsk. from India n = 20.

Observations are recorded on the size of the chromosomes of *S. versicola*, *S. vulgare* and *S. halepensis* and the relation between chromosome number and cross-pollination is mentioned and also an instance of partial sterility that occurred in the progeny of a cross between a kafir and a milo of identical chromosome number, morphological and physical differences being the cause of the failure to reproduce. Attempts to cross *S. versicola* with *S. vulgare*, with *S. virgatum* (n = 10) and with *S. halepensis* have not succeeded so far. Other grass-sorghum crosses and a possible relation between the perennial and annual habit and doubling of the chromosome number are referred to. In conclusion the possibility is indicated of altering the existing botanical classification of the genus *Sorghum* to make it consistent with the cytological data that have been accumulated.

213. 633.174:581.466:575.11
KARPER, R. E. and STEPHENS, J. C. 633.174:575.123
Floral abnormalities in sorghum.
J. Hered. 1936 : **27** : 183–94.

The following inherited abnormalities are described :—

Antherless flowers, a simple recessive character involving the production of several ovaries but no anthers, first discovered in the progeny of a dwarf Sudan grass selection. This character is being transferred to grain and sweet sorghums and it is hoped to utilize it in the production of F_1 hybrid seed for commercial planting, to take advantage of the marked heterosis of sorghum hybrids.

Multiflorous, a proliferation of spikelets within a spikelet, stamens and pistils usually being absent. This also is a simple recessive and the plants are sterile.

A character behaving as a simple dominant is the twin-seeded condition observed in certain durra varieties from India, in which the lower flower of the spikelet becomes functional.

Other abnormalities, dependent more on the environment for their expression are also described

RICE 633.18

214. GUŠČIN, G. G. 633.18:575(47)
(A uniform method of breeding work in rice).
Bull. Appl. Bot. Leningrad 1935 : Ser. A (16) : 19–30.

One of the main desiderata in connexion with rice in the Soviet Union is the production of varieties suitable for mechanical harvesting, for which purpose forms free from shattering and lodging and with tall stems must be selected. The length of spikelet, rachilla and the form of the base of the spikelet are somewhat different in shattering and non-shattering forms and these characters may serve as valuable guides in selection. Field and laboratory observations are made on degree and type of lodging and laboratory experiments are made on the strength of straw. The presence of awns greatly reduces the quality, especially for mechanical harvesting, and awnless forms are therefore to be selected.

The extension of rice cultivation into new regions will require the production of varieties possessed of earlier maturity, resistance to salinity or to low water supply and to the main diseases and pests.
The rice fields at present are very mixed, containing not infrequently up to 8 or 10 different botanical varieties, and considerable improvement can be effected by mass selection. The principles and methods of individual plant selection as applied to rice in the U.S.S.R. are also described, leading to the method of hybridization. For this purpose a very thorough study of the individual varieties is necessary in order to know which is suitable for crossing for definite purposes. A knowledge of the time of flowering of the different varieties is of particular importance in making successful crossings. By maintaining certain conditions it should be possible to grow the rice plant in the greenhouse in the winter after harvest and maintain it in the vegetative stage until the following season, by which time the F_1 plants, most of which moreover display heterosis, can be grown on during a number of seasons. By similar methods hybrid seeds can be grown immediately after harvesting.
The method of artificial hybridization is described and the importance is stressed of guarding against out-pollination. As rice is very sensitive to slight changes in growth conditions it is important that all breeding be done with the needs of definite regions in mind.

215. KANNA, B. 633.18:575.243.061.6:537.531
Chlorophyll deficient rice seedlings induced by X-rays.
J. Coll. Agric. Tokyo 1935 : **13** : 363–71.

Twelve chlorophyll deficient mutants occurring in the progeny of a pure line of rice which had been treated with X-rays are described. All behave as simple recessives and all are lethal with the exception of one called " greenish yellow," which may occasionally survive.

216. TAKEZAKI, Y. 633.18:581.162.5:575:581.331.2
Vererbung einiger unfruchtbaren Sumpfreissippen. (**Inheritance in some sterile strains of swamp rice**).
Pflanzen u. Tiere 1932 : **7** : 387–97, 2255–67 ; 1933 : **8** : 687–706.

Forms, either partially or completely sterile, were obtained from crosses of certain swamp rice strains. The various degrees of sterility and their possible causes are discussed in an account of a long series of experiments with such strains.

ROOTS AND TUBERS 633.4

217. 633.42–2.411.1–1.521.6
633.42 Immuna
LAMPRECHT, H. and HERTZMAN, N. 633.42 Ostgöta II
Weibulls Immuna rova, stam 8, och Weibulls Ostgöta II kålrot, stam 3. Två nya, mot klumprotsjuka mycket motståndskraftiga stammar. (**Weibulls turnip Immuna, strain 8, and Weibulls swede Ostgöla II, strain 3. Two new strains very resistant to club root**).
Weibulls Ill. Årsb. 1935 : **30** : 28–32.

The two new forms, both shewing a marked improvement over existing forms in resistance to club root (*Plasmodiophora*) are described.

218. WENK, H. 633.491:575.1
Kartoffelzüchtungsfragen. I. Teil : Staudenauslese und Pflanzgutbau bei Kartoffeln. (**Questions of potato breeding. Part I : Plant selection and cultivation in potatoes**).
Prakt. Bl. Pflanzenb. 1936 : **14** : 2–13.

The results of many years' selection for increased yield in the older forms shewed that no improvement was made by this means. Investigations on the selection of apparently healthy plants within a clone susceptible to leaf-roll shewed that the disease was transmitted to the progeny.
The behaviour of the plants during the ripening period proved to be a useful indication of their value, those which turned yellow and died off gradually transferred all their food substances to the tubers, while those which remained bright green gave only a poor yield.

Spacing experiments have been carried out and the results provided an opportunity for a study of the relation of spacing to soil and size of tuber. Under the climatic conditions of Weihenstephan and on light soil with close spacing and the use of not too small tubers, a very satisfactory yield of seed potatoes was obtained. Virus diseases are being studied and use is being made of the method of testing shoots detached from the tuber and grown separately in the greenhouse. The results shew an agreement of 90 per cent with those in the field.
The present work is concerned with the production and maintenance by plant selection of healthy varieties, as the success of potato breeding lies in the use of sound seed.

219. Tikhonov, P. M. and Demidovič, A. F. 633.491:575.11
(The inheritance of farming characters and results of potato selection).
Izvestija Agronomičeskogo Fakul'teta Saratovskogo Universiteta (Rep. Agric. Fac. Saratov Univ.) 1935 : 96–117.

The yields per plant are given, in the form of frequency distributions, for the F_1 generations of a number of crosses. In all crosses wide segregation was observed, going far beyond the parental limits. The greatest variability was observed in the combination Narodnyi x Parnassia, where the yield went up to 1,200 grm. per plant and, with isolated individuals, reaching 1,600 grm. Parnassia x Granat gave the least variation. All curves shew a marked asymmetry towards the lower yields, indicating that factors for low yield are dominant. Certain crosses also contained isolated individuals with exceptionally high yields, deviating from the arithmetic mean of the population by over 95. This occurred in the crosses Narodnyi x Parnassia, Narodnyi x Granat and even in Parnassia x Granat.
The cross Granat x Fürstenkrone was studied also in the F_2, in which the range of variation was wider still than in the F_1 : as the F_2 was obtained by selfing there was a greater tendency for partially homozygous forms to separate out and a distinct bimodal formation of the curve of distribution for yield.
Similar behaviour was obtained in respect of time of maturity, lateness being the dominant type. Certain early maturing forms segregated out in the F_2. In some crosses a correlation between early maturity and high yield was obtained.
The inheritance of starch content was distinctly less complicated, there being evidently not so many factors at work, and the character was not correlated with either yield or earliness. Measurements were also made of the size of the starch grains and it was found that the earlier forms had larger starch grains, whilst the size of the starch grains tended to be more uniform in the small grained forms, which makes the combination of largeness and uniformity of the starch grains difficult.
As regards the practical side of the work, out of 10 000 seedlings raised in 1932, involving seventeen intraspecific and three interspecific combinations, the most promising were Narodnyi x Parnassia, Narodnyi x Granat, Wohltmann x Fürstenkrone and Granat x Fürstenkrone. By careful selection it has been possible to select superior seedlings in respect of yield, starch content, immunity, keeping capacity, form of tubers and earliness, and the data for the best lines are reproduced in brief. The best lines in 1934 gave yields of up to 488 centner per ha. and some of them contained as much as 18 per cent of starch.

220. 633.491–2–1.521.6:575(77.4)
Wheeler, E. J. 633.491:581.6
Progress made in the breeding program in Michigan in 1935.
Amer. Potato J. 1936 : **13** : 159–62.

The main breeding work is done at the Michigan State College, East Lansing, with sub-stations in different parts of the State. A white-skinned variety to replace Russet Rural is needed, the ideal being medium in maturity, smooth-skinned, shallow-eyed, free from second growth and hollow heart and resistant to virus diseases and common scab (*Actinomyces*).
In 1935 several crosses were made between good vigorous seedlings, seedlings resistant to scab and yellow dwarf, and inbred lines. Selection was performed for resistance to scab and yellow dwarf. The breeding of seedlings adapted to muck soils is also proceeding. Agronomic and cooking tests are made with new varieties and promising seedlings.

221. 633.491–2.411.4–1.521.6:575
633.491–2.111–1.521.6:575
63.00.15(47)

[Krasnyi Pakhar. Northern Experimental Base of the Institute of Plant Industry.]

Lenin Acad. Agric. Sci. Inst. Pl. Ind., Leningrad and Moscow 1935 : Pp. 114.

In this short bulletin a description is given of the northern experimental farm of the Leningrad Institute of Plant Industry, which is situated at a latitude of 59°41′ north and known as Krasnyi Pakhar. Here all the new varieties produced by the breeders are tried out, together with a number of standard varieties and supplies of initial breeding material. Special attention is given to new hardy forms of southern fruit trees and vegetables whose cultivation in the north has hitherto been precarious or impossible. Descriptions are given of the most interesting varieties growing and of their special merits. These include large numbers of Michurin's fruits, and the collection of South American potato species and a number of their hybrids. Among the latter are diploid (2n = 24) hybrids of *Solanum ajanhuiri* x *S. Bukasovii* capable of tolerating −5°C., and other frost-resistant hybrids, including triploid hybrids between Epicure and *S. Bukasovii* and *S. ajanhuiri* and their hybrids. There are also hybrids between *S. acaule* and various other species. The hybrids with *S. Bukasovii* and *S. phureja* are very hardy, withstanding −7°C., but are sterile and form no tubers. These hybrids will be further crossed with *S. andigenum* and *S. tuberosum.*

There are also hybrids of a number of domestic varieties and of *S. andigenum* with *S. curtilobum* capable of withstanding varying degrees of frost, down to −5°C. The hybrids with *S. tuberosum* were more uniform, vigorous and hardy than those with *S. andigenum* and some of them shewed a relatively high degree of fertility in the F_1 and F_2 generations. Among the most promising as regards yield are the triple hybrids Epicure x (*S. curtilobum* x *S. tuberosum*). Best of all in yield are the hybrids *S. andigenum* x *S. tuberosum.* Of the former species the forms *pacus* and *taccla* were taken on account of their possessing a certain amount of frost-resistance. Some of these hybrids also exceeded the parental forms in blight resistance and many are of distinct promise as regards commercial qualities. Certain hybrids have now been obtained between *S. tuberosum* and *S. semidemissum* some of which are resistant both to −7°C. of frost and to *Phytophthora.* All the hybrids of *S. tuberosum* and *S. andigenum* with *S. demissum* are resistant to −5°C. They are self-sterile but F_2 families have been obtained from two hybrids and also by back-crossing with domestic potatoes ; some of the forms segregating are fairly high yielding. Only about 1 per cent of them were attacked by blight in the field, and definite hopes are entertained of obtaining commercially desirable forms combining frost and blight resistance from these hybrids in three or four generations.

Blight-resistant forms not resistant to frost have been obtained by crossing certain other species with *S. tuberosum* and *S. andigenum*, e.g. *S. Antipoviczii.* These hybrids were entirely free from blight attack and in back-crosses with *S. tuberosum* frequently gave yields excelling the latter species. Other species of interest in breeding for blight resistance are *S. ajuscoense*, *S. Vallis Mexici*, *S. Verrucosum*, *S. coyoacanum*, *S. bulbocastanum*, *S. dolyadenium* and *S. Millanii.* The latter species is also frost-resistant.

The merits of a number of other tuberous plants from South America are referred to, after which the varieties of other horticultural plants at Krasnyi Pakhar are described.

222. Cruger. 633.491–2.412.5–1.521.6–1.521.5

Wie entstehen die krebsfesten Kartoffelsorten ? (**How are potato varieties immune to wart disease obtained ?**).

Georgine 1934 : **111** (52) : p. 2.

An account, written for the agricultural press, of the official and scientific measures taken in Germany to ensure that all new varieties of potatoes for seed shall be characterized by purity of seed, trueness to type and immunity to wart disease.

The work of the Biological Institute at Dahlem, which, with other stations, has tested about 150,000 strains of potatoes for breeders during the past 6–7 years, receives special mention.

223. MILLER, J. C. 633.492:575.252:537.531
Further studies of mutations of the Porto Rico sweet potato.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 460–65.
Descriptions are given of the Porto Rico variety and of four naturally occurring mutant types which have been found in it, differing from each other in skin colour, flesh colour, flavour, chemical composition and yield. A mutation similar to one of these was induced by X-ray treatment.
The frequent occurrence of somatic mutations indicates the importance of continued selection to preserve the quality of a given strain.

FIBRES 633.5

224. BORDAKOV, L. P. 633.51:575
Züchtung der Baumwolle. (**The breeding of cotton**).
Z. Zücht. 1936 : A **21** : 68–84.
A review of the literature on the genetics of cotton.

225. 633.51:575.1
633.51:575(47)
(**The genetics, breeding and seed production of cotton**).
Sredaz NIHI, Central Breeding Station, published by Sel'khozgiz, Moscow and Leningrad 1933 : Pp. 276.
A full description is given of the morphology, anatomy and development of the cotton plant, of the reproductive organs and of the lint.
In the section on classification, the view of Zaitsev that the four groups of cottons established by him are quite independent and have no intermediate forms is shewn to be untenable and even the groups differing in chromosome number are now known to be capable of crossing and giving partially fertile hybrids. The wild species are now found, contrary to the view of Zaitsev, to be also related genetically, and hence phylogenetically, to the various groups of cultivated cottons. The classifications of other authors are shewn to be equally unsatisfactory and an entirely new classification based on enlarged genetical and cytological knowledge is necessary. The most clearly defined of the existing species are described.
In the section on genetics, the range of variability of different economic characters in the cotton plant is discussed. The inheritance of the various characters is illustrated by analysing crosses of forms differing in boll size, lint length, earliness, ginning out-turn, fuzz, type of inflorescence and length of sympodial branches in *G. hirsutum*, and for certain characters also in *G. herbaceum*. The inheritance of certain qualitative characters is also described, such as dehiscence, and non-dehiscence of bolls, brown colour of lint, petal spot and form of leaf.
Interspecific crosses between Upland and Egyptian cottons have produced very fine F_1 plants, excelling both parental species in lint qualities and yield and also in important agronomic characters such as drought and frost resistance. A method has been devised for producing unusually large quantities of seed by hybridization and both this and a successful method of vegetative reproduction recently elaborated will be applied in order to make use of these F_1 hybrids for growing on a commercial scale. Constant families have been obtained in the third generation from a cross made in 1927 that are superior to both parents in respect of earliness, total yield and size of bolls, whilst in lint length they are intermediate, more nearly approaching the Upland parent. Further crosses are being made with them to improve their lint qualities.
Hybrids have now been obtained between the 26 and 52 chromosome cotton species in nearly all combinations and also several complex hybrids have been produced. Thus in 1928 a quadruple hybrid was obtained at Tashkent by crossing the hybrid *G. hirsutum* x *G. barbadense* with the hybrid *G. Nanking* x *G. herbaceum*. In 1930 this hybrid produced one boll with four normally developed seeds, giving rise to an F_2 which proved fertile in 1932.
Hybrids between the two chromosome groups occur even naturally, and contrary to Zaitsev's opinion the reciprocal hybrids are equally successful and are alike in characters. The percentage

success varies from 0·01 to 2–2·5 per cent. The hybrids sometimes exceed the parental species by as much as 2 –3 times in size. In characters they are largely intermediate, though there is a tendency for the characters of the 52 chromosome form to be dominant. The pollen is largely sterile, though a few good pollen grains are formed ; in almost all combinations, however, seed is set when the hybrids are pollinated with the parental species, especially when the 52 chromosome species is used. In the F_2 so produced great variations in forms and characters appear which are not known in either parental species, some indeed which are unknown in the genus *Gossypium*, such as small flattened bolls. The fertility varies from very low to almost 100 per cent. One particularly interesting hybrid has been obtained of (*G. barbadense* x *G. herbaceum*) x *G. barbadense* distinguished by great fertility and capable of crossing also with *G. barbadense*, *G. arboreum* and *G. hirsutum*. It affords a means therefore of combining the characters of *G. herbaceum* with all these species.

Only one F_3 has been studied, namely (*G. barbadense* x *G. arboreum*) x *G. barbadense*. Here again there is a great variety of forms produced ; certain plants of the Egyptian type possessed of great fertility and earliness appeared ; others combining the characters of the Egyptian and Indian cottons, forms intermediate between the parents and some with quite new combinations of characters. From these results great hope may be placed in interspecific hybridization which offers the further possibility of producing forms with increased chromosome number.

Mutations have been produced in cotton by the action of X-rays and have affected nearly all possible organs of the plant. Among the mutations observed there appear various floral anomalies, unusual size or dwarfness of the plant, or of certain organs, and forms with increased productivity and with earlier maturity have also occurred. One mutant from the variety 1306 Schroeder was distinguished by an increased number of shortened nodes on the sympodial branches resulting in a larger number of bolls per branch, associated with a more compact growth and greater number of sympodial branches, the combined effect of which was to produce a yield 3–4 times above the normal. Unusual forms have also been obtained by the action of narcotics on the growing point.

A brief history is given of the development of cotton breeding in the Soviet Union, followed by an outline of the present practical breeding work. This work is carried out on the lines of improving the yield and quality of the Upland varieties grown, selecting Egyptian cottons capable of growing in Turkistan, and varieties suitable for mechanical harvesting, with earlier maturity and tolerant of adverse growth conditions such as drought, storms, frost and salinity. The closed bolls of most forms of *G. herbaceum* represent a valuable feature in connexion with mechanical harvesting and wind resistance and as certain quite desirable characters are found scattered among different forms of this species, such as high productivity in some, long silky lint (up to 35 mm.) in others, etc., the plan is now to intercross these various forms so as to produce an improved type of *G. herbaceum*.

Other lines of selection are for naked seeds, which are found to germinate more readily, and for resistance to wilt, gummosis and other diseases. The value of breeding work is illustrated by the fact that Egyptian cotton can now be grown over large areas of Central Asia, where its cultivation was previously said to be impossible, and earlier forms capable of growing in more unfavourable districts are still being evolved. Among the improved forms of Sea Island produced are mentioned No. 4684, a selection of Ashmouni, with lint 40–41 mm. in length and exceeding the original Ashmouni in yield of lint by 20–25 per cent ; No. 4430, a similar selection giving an increased ginning out-turn of 0·5 per cent and an increase of 4·5 mm. in lint length, and exceeding the original Ashmouni by 10–30 per cent in yield ; No. 4384, an earlier form of Ashmouni by 3–5 days, exceeding it in lint length by 3–5 mm. and in yield by 10–30 per cent. Improved lines of Pima have also been obtained, No. 4202 exceeding it by 4–7 days in earliness, by 3–4 per cent in ginning out-turn and 30–50 per cent in yield, No. 5585 exceeding it by 2–4 days in earliness, 1–2 per cent in ginning out-turn, 2–3 mm. in lint length and 20–40 per cent in yield. From the variety Boss line No. 4680 has been selected, exceeding the parent by 7–9 mm. in lint length and 20–25 per cent in yield.

Descriptions are given of all the varieties of cotton grown in the Soviet cotton areas, including the newest improved selections of the Soviet breeders. The volume closes with chapters on seed production and control and on methods of cultivation.

226. HARLAND, S. C. 633.51:575.11.061.6:575.127.2
Duplicate genes for corolla colour in *Gossypium barbadense* L. and *G. Darwinii* Watt.
Z. indukt, Abstamm. -u. VererbLehre. 1936 : **71** : 417–19.
The 26 chromosome species of cotton *G. Darwinii* Watt., endemic in the Galapagos islands, has been fully investigated and the results will be published elsewhere. In the present note the author deals with the genetics of the corolla colour.
Crosses between *G. barbadense* and *G. Darwinii*, both with bright yellow corolla, gave an all yellow F_1 but in the F_1 and F_2 back-crossed to recessive white a number of white and cream plants occurred, indicating the existence of duplicate genes which are designated as Y^B (*barbadense*) and Y^D (*Darwinii*) and making the fourth case of duplicate genes recorded in the amphidiploid New World cottons.

227. GATES, R. R. 633.51:576.312
Étude cytologique des cotonniers. (**A cytological study of the cottons**).
Cot. et Cult. Cotonn. 1936 : **10** : 1–12.
An explanatory account of work on the cytology of the cottons including findings relating to chromosome numbers, polyploidy, interspecific hybridization and the origin of various types of cotton.

228. ELLENHORN, J. 633.51:578.65:576.356.5
Verschiedene Chromosomenfärbung in der Meiosis von *Gossypium peruvianum*.
(**Differential chromosome staining at meiosis in *G. peruvianum***).
Cytologia, Tokyo 1936 : **7** : 213–18.
In pollen mother cell preparations of a New World cotton fixed in Navaschin's fluid and stained with iron alum-haematoxylin there were to be seen at second metaphase thirteen deeply stained and thirteen lightly stained chromosomes, the regularity and certain other features of the phenomenon betokening a real difference between the two sets. It is suggested that this difference is in the nature of amphiplasty.
Secondary pairing was observed, in which 24 of the 26 chromosomes participated, and was always between similarly stained chromosomes. The results are taken to confirm the hypothesis that the New World cottons are modified octoploids (Cf. " Plant Breeding Abstracts " Vol. IV, Abst. 320).

229. HARLAND, S. C. 633.51:581.481:576.356.52:575
Haploids in polyembryonic seeds of Sea Island cotton.
J. Hered. 1936 : **27** : 229–31.
Seeds containing two embryos were found in the Sea Island strain V. 135 and when sixteen of the pairs of plants were raised to maturity, fourteen pairs were found to consist of one haploid and one diploid plant. It is suggested that this polyembryonic haploidy is the cause of the one haploid in three or four thousand plants which occurs in commercial fields of Sea Island cottons. Haploids have also been reported in Upland cottons (*Gossypium hirsutum* L.) and in the strains from crosses between *G. hirsutum* and *G. barbadense*.
The Sea Island haploids shew a certain amount of fertility on the female side, varying according to the strain from which they arose. One haploid set practically every boll when pollinated by normal Sea Island pollen and even with pollen from the 13-chromosome species *G. arboreum*, *G. harknessii*, *G. armourianum*, *G. anomalum*, *G. trilobum* and *G. aridum*. The two recorded Upland haploids were completely sterile.
The value of the haploids in breeding lies in the stable background they provide for back-crossing work, when maintained by vegetative propagation. Although repeated back-crossing of a diploid to the haploid may not reduce heterozygosity any faster than self-fertilization, the stable genotype of the haploid provides a base towards which the product of repeated back-crosses continually converges and if desirable characters can be obtained in a haploid, e.g. from a cross between *G. hirsutum* and *G. barbadense*, their incorporation in a diploid would be ensured by this method. A further advantage is that undesirable recessives can be detected by inspection in the haploid.

Crosses of Sea Island cotton with 13-chromosome species are likely to be more easily produced when the haploid (n = 26) is used as the female parent. It was hoped by such crosses that the two sub-genoms of the amphidiploid *G. barbadense* might be separated, but so far the crosses of 13-chromosome species with both haploid and diploid Sea Island cottons have been identical. It is suggested that polyembryony in Sea Island cotton may be due to some genetic disharmony, arising from the meeting of two unlike genoms in this amphidiploid form.

230. 633.51–1.524.4

BORDAKOV, L. P. and IVANOVA, M. M. 633.51 *G. herbaceum* (58)

(The importance of the local cottons of Afghanistan for practical breeding work in the U.S.S.R).

Bull. Appl. Bot. Leningrad 1935 : Ser. A (16) : 79–94.

The Afghan cottons, mostly belonging to *Gossypium herbaceum* are of interest in breeding on account of their closed bolls (of value for mechanical harvesting and in windy districts), some of which are very large and contain long, white, silky lint, varying from 15 to 30 mm. in length, with a ginning out-turn of over 25 per cent. They appear to be drought-resistant and are not subject to shedding. Their general high quality and range of variation make this species worthy of much more attention than it has yet received. Other interesting characters occurring in the group are the absence of petal spot, principally in the region of Herat, exceedingly early forms near Kabul and peculiar forms with the tips of the valves bent down.

The characteristics of the cottons of different parts of the country are described and illustrated; many features are pointed out in which they resemble the local cottons of Central Asia and it is suggested that the latter are derived from Afghanistan, contrary to the reverse opinion expressed by Zaitsev and others. These forms are mainly found in the foothills and the closed-boll forms are concentrated in the high mountains in the neighbourhood of Herat. Here there is a remarkable variety of forms of this type, some of which proved highly valuable from the point of view of their long silky fibre, and the region is obviously a very ancient centre of these cottons. They are to be used extensively in breeding.

The cottons of other species found in Afghanistan are apparently of an adventive nature.

231. WATKINS, G. M. 633.526.43:576.312.35:576.31

Chromosome numbers and species characters in Yucca.

Amer. J. Bot. 1936 : **23** : 328–33.

A study was made of chromosome numbers in relation to species characters in *Yucca aloifolia*, *Y. radiosa*, *Y. filamentosa*, *Y. glauca*, *Y. arkansana* and *Y. louisianensis*, the chromosome numbers of the last two never having been previously recorded.

Y. arkansana and *Y. glauca* shewed in the root tips 60 to be the diploid number, composed of 10 large and 50 small chromosomes. Evidence of somatic pairing of homologues was discovered. Equitorial plates of the meiotic divisions in microsporogenesis of *Y. aloifolia*, *Y. filamentosa*, *Y. louisianensis* and *Y. radiosa* (synonym *Y. elata*) shewed 30 chromosomes, 5 long and 25 very short. Similarity was observed between the arrangement and relative sizes of the chromosomes in the various species.

In considering the very great variation in size found in the species of *Yucca* and the cytological data so far obtained the writer concludes that a great increase in size of the plant is not correlated with polyploidy nor apparently with any marked increase in chromatin mass.

Navashin's study of the relation between the amount of chromatin and cell size is discussed and a certain correlation between the relative amounts of chromatin in the nuclei and the relative sizes of the plants of *Y. louisianensis*, *Y. aloifolia* and *Y. radiosa* is shewn to exist.

The relationship of chromosome numbers and karyotypes to the taxonomy of the *Dracaenoideae* and the *Agavoideae* is also discussed.

SUGAR PLANTS 633.6

232. 633.61

Anciennes variétés de cannes. **(Old cane varieties).**

Leaflet inserted in Rev. Agric. Maurice 1936 : No. 86.

A request is made for material of a number of old cane varieties required for breeding purposes.

233. 633.61 POJ 2714V
633.61:575.242

CAMINHA, A. (Jr.)
Cane culture in Brazil.
Brasil Azucareiro 1935 : **4** : 335–41.

In this account of the performance of the imported POJ varieties under Brazilian conditions, mention is made of a bud variation, POJ 2714V, found in São Paulo superior to POJ 2714 from which it arose. The mutation is being propagated.

234. 633.61:575(76.3)
633.61–2–1.521.6

A general summary of experiments with sugarcane.
TAGGART, W. G., GOUAUX, C. B. and SIMON, E. C.
Part I. Work of the Sugar Experiment Station.
EDGERTON, C. W. and TIMS, E. C. [MILLS, P. J.]
Part II. Testing canes for disease resistance in Louisiana.
HINDS, W. E. and OSTERBERGER, B. A.
Part III. Recommendations for control of the sugarcane borer in Louisiana.
Bull. La Agric. Exp. Sta. 1935 : No. 267 : 2–7, 7–12, 12–16.

Part I of this bulletin deals with the work of the Sugar Experiment Station at Baton Rouge. The behaviour, yield and chemical properties of some of the recently introduced varieties are described.
The station has developed a method known as the single eye method of summer planting whereby new varieties can be rapidly multiplied and placed under general commercial cultivation five or six years earlier than by ordinary methods of planting.
Using the Zeiss hand refractometer a simple, practical and rapid method for determining the maturity of cane in the field has been developed.
Part II deals with testing canes for disease resistance in Louisiana. The three most important diseases are : the stubble deterioration complex of factors (i.e. cold, excessive soil moisture and various fungous diseases), red rot and mosaic.The methods of testing and the reactions of recently released varieties to these adverse factors are briefly described. Taking all the diseases into consideration, C.P. 28-11, C.P. 28–19, C.P. 29–320 and Co 290 are the most promising varieties.

235. 633.61:575(92.2)
633.61:576.42:581.165

Verslag der cultuurafdeeling van het Proefstation voor de Java-Suikerindustrie te Pasoeroean over het jaar 1935. (**Report on the agricultural division of the Proefstation Java-Suikerindustrie at Pasoeroean for the year 1935**).
Jversl. Ver. Proefst. Java-Suikerind. 1935 : Pp. 25.

At Pasoeroean sugar cane clones numbering 185 were cytologically examined and the chromosome numbers determined. Similar determinations were also carried out in Holland.
Seedlings numbering 62,026 were obtained from 327 combinations, 16,181 of these seedlings (from 67 combinations) were planted out with a view to cytological examination.
Selection work is being continued both by the Station and on 42 estates inspected by it ; 364 new seedlings are undergoing comparative trials in test plots.

236. 633.61:575(96.9)
633.61:576.312.35

MANGELSDORF, A. J. and LENNOX, C. G.
Genetics. Report of the Committee in charge of the Experiment Station.
Proc. 55th Ann. Meet. Hawaii. Sug. Pl. Ass. 1935 : 38–45.

Primary considerations in the 1935 season were disease resistance and high sucrose content. Crosses between Co. 290 and certain local canes yielded some unusually fine seedlings. The

new varieties 31–1203, 31 1389 and 31–2538 produced tassels for the first time and were used for crossing ; the progeny of the second are especially promising.
A new method, called ' melting pot,' was used in which tassels from several hundred breeding canes were set up in a breeding rack and their positions shuffled daily. The male parentage of the resulting seedlings is unknown but the chance of securing good canes and discovering canes capable of transmitting desirable qualities is much enhanced.
After a statement of the seedlings under trial at the regional stations a list, with brief comments, is given of the canes which are shewing promise on plantations. In the four co-operative variety tests on plantations in which it occurred, 31–1389 equalled or outyielded its competitors.
Cytological studies of a number of forms of *S. spontaneum* with crosses involving these forms indicate chromosome numbers ranging from n = 32 to n = 68 ; H 456, n =42 ; Natal Uba n = 58 ; 28–4784, a cross between the two last, n = 50 ; Hawaiian Uba n = 68 and 28 -4291, a cross between Hawaiian Uba and H 456, n = 55. H.M.L.

237. FORT, C. A. and WALTON, C. F. 633.61:581.6:575
Quality of sugar-house sirups from the newer cane varieties.
Sug. Bull. N.O. 1936 : **14** : No. 15 : 5–6
Juices were obtained from cane samples of the newly released varieties C.P. 28–11, 28–19 and 29–320, as well as POJ. 213 and Co. 290, grown in the Louisiana sugar cane belt and by randomized replication of the varieties in small adjacent plots in the test fields the reliability of the varietal comparisons was ensured.
The results are tabulated and discussed from the technical and economic standpoint. The variety tests are being continued.

238. JENSON, J. H. 633.61–2–1.521.6(72.95)
Notes on the present sugarcane-disease situation in Puerto Rico.
Agric. Notes P. Rico 1936 : No. 69 : Pp. 8.
The most important disease in Puerto Rico is mosaic, which is being controlled by roguing and by growing resistant varieties. Evidence has been obtained suggesting that there are at least two strains of mosaic. Other diseases mentioned are gummosis, eye-spot (*Helminthosporium ocellum*), brown-stripe disease (*H. stenospilum*), ring-spot disease (*Leptosphaeria sacchari*), red-stripe (*Phytomonas rubrilineans*), dry-top rot (*Plasmodiophora vascularum*), red rot (*Colletotrichum falcatum*), *Fusarium* pokkah boeng (*F. moniliforme*) and chlorosis caused by manganese deficiency. Losses from gummosis have been practically eliminated by the growing of resistant varieties. The variety Co. 281 was found to be resistant to chlorosis, a disease which caused considerable damage in susceptible varieties such as P.O.J. 2878, Mayaguez 28 and B.H. 10(12).

239. ABBOT, E. V. 633.61–2.483–1.521.6:575
Importance économique de la morve rouge aux États–Unis d'Amérique et sensibilité comparée de quelques variétés de canne à sucre. (**Economic importance of red rot in the United States of America and comparative comparative susceptibility of some varieties of sugar cane**).
Rev. Agric. Réunion 1935 : **40** : 355–56.
An abstract in French of the article reviewed in " Plant Breeding Abstracts," Vol. VI, Abst. 213.

240. 633.61-2.8–1.521.6(76.3)
TIMS, E. C., MILLS, P. J. and EDGERTON, C. W. 632.8:576.16
Studies on sugarcane mosaic in Louisiana.
Bull. La Univ. Agric. Mech. Coll. 1935 : No. 263 ; Pp. 39.
A general survey based on observations and tests.
There are two main types of mosaic in Louisiana, a green and a yellow, of which the latter is much more injurious. Certain P.O.J. and Co. varieties which were at first resistant to the disease later suddenly became susceptible. From this and other evidence it is suggested that different

strains of the virus occur. Within susceptible cane varieties strains could be selected which were apparently resistant or tolerant, as they carried the disease but only shewed mild symptoms. Their susceptible reaction in inoculation tests, however, indicated that they had been merely carrying a mild strain of the virus.
The canes which are receiving most consideration at the present time are C.P. 28–11, C.P. 28–19 and C.P. 29–320, bred at Canal Point, Florida. These are not immune, but mosaic does not attack them to a sufficient extent to be of economic importance.

241. 633.61.00.14
Cross, W. E. 633.61:575(82)
Las cañas " tucumanas " de semillero. Informe de los ensayos del año agricola 1933-1934. (**The Tucuman seedling canes. Report on the tests of the year 1933–34**).
Rev. Industr. Agric. Tucuman, 1934 : **24** : 229–67.
The results of a further year's tests (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 1041) of the various series of seedlings are presented and the various canes are described with indications of those that appear promising. Especially so are certain canes from the cross Co. 243 x Co. 244, some of them giving yields of sugar per hectare of 9·5 to 11 kg. as compared with 9.14 for the standard P.O.J. 36.
Seedlings obtained by selfing Co. 205 produced a large bulk of cane, but were somewhat below P.O.J. 36 in sugar content. Hybrids between P.O.J. 2725 and Manoa 315 also exceeded P.O.J.36 in yield of sugar per row, one of these canes in particular, Tuc. 1596, being remarkable in its combination of high yield of cane and sugar content ; many others were outstanding in this same respect and this is thought to be a very promising parental combination.
The selfed seedlings of P.O.J. 2878 were very varied in character and though mostly inferior to the parent, some of them proved superior to the standard. Some of the seedlings of S.C. 12/4 also exceeded the standard in both yield and sugar content.

242. 633.63:575(43)
Sugar beet seed breeding. Fifty years of progress, 1884–1934.
Published by G. Schreiber and Sohn, Nordhausen. Pp. 27.
A brief account of the breeding work of Messrs G. Schreiber and Sohn, with indications of the respective values of the three strains they produce.

243. Sedlmayr, C. 633.63:575(43.6)
Soll in Österreich wieder Zuckerrübe gezüchtet werden ? (**Should sugar beet be bred in Austria again ?**)
Wien. Landw. Ztg. 1935 : **85** : 334–35.
Home sugar beet production would be desirable from the economic standpoint only if the home products were at least equal to the foreign. As another alternative one could import pedigree seed of foreign varieties of proved value and carry out multiplication under the control of the breeder. From the economic standpoint as regards the individual sugar beet breeding, this can only be carried on if the raising of beet is a paying proposition. For this, years of practice and trained workers are necessary. Furthermore, the question of a satisfactory market plays an important part, since beet seed is entirely useless for any other purpose except sowing. Comparative variety tests, such as have been held by the Bundesanstalt für Pflanzenbau und Samenprüfung in all districts devoted to sugar beet cultivation in Austria for some years past, are welcomed by the farmer, the factory and the beet breeder. The varieties from the west are suitable for certain sugar beet districts of Austria but not for Pannonia. In general, breeding operations can only be successfully carried out under the same conditions under which the variety that is being bred is to be cultivated. The desirable characteristics for suitable beet for cultivation in Pannonia are enumerated and the importance of Zederbauer's technique of osmotic pressure determinations in breeding for resistance to *Cercospora beticola* and to drought is mentioned.
On the whole sugar beet breeding in Austria is confronted by serious difficulties.

A.B.

244. 633.63:575–181:576.356.5
CLAUS, E. 633.63:576.312.35
Zur Chromosomenforschung bei der Zuckerrübe. (**On chromosome investigations in the sugar beet**).
Zuckerrübenbau 1933 : **15** (9) : Pp. 4.

Observations on a number of giant specimens with proportionately high sugar content that were found in commercial strains of sugar beet (obtained by individual selection or by race crossing) shewed that though the actual gigas type might not be inherited the progeny shewed a tendency towards an increase in the average weight of the beet. Chromosome studies were made in order to determine whether or not the forms in question were polyploid or heteroploid. For purposes of comparison the chromosome numbers of normal sugar beet, and of *Beta maritima*, *B. cida* and crosses with sugar beets were also determined, and nine was found to be the haploid number in all four groups. The gigas forms too shewed n = 9, no polyploids having been formed so far. Heteroploidy, however, was found to occur as well as fragmentations, and various types of aberrations before and during the reduction division.

A note is included on the method used in a number of pollinations made with a view to further inheritance studies.

245. BLEIER, H. 633.63:575.127.2:576.356.5
Ueber Chromosomen- und Züchtungsfragen der Zuckerrübe. (**On chromosome and breeding problems in the sugar beet**).
Zuckerrübenbau 1936 : **18** : 73–82.

The anomalies of pairing that occur in the reduction division of a hybrid *Beta vulgaris* (n = 9) x *trigyna* (n = 27) are characterized in general by the formation of 9 trivalents by the *B. trigyna* genom, while the 9 sugar beet chromosomes remain unpaired. Subsequent disturbances due to unequal distribution of the chromosomes of the trivalents and univalents to the poles may result in the production of pollen and ovules lacking a complete genom and hence non-functional—a fact which explains the sterility of the hybrid.

The various modes of obtaining tetraploid shoots with a view to the production of gigas forms are mentioned and also the results of successful experiments made by the author to induce the formation of restitution nuclei in the sugar beet by subjecting the dividing cells to high temperature. Tetraploid plants, however, obtained in this way may exhibit varying degrees of sterility if the pairing of the four similar genoms of 9 chromosomes each should happen to form any other association but 18 pairs which alone produces a true breeding gigas form.

The author believes that *B. trigyna* is probably an autohexaploid and has possibly been derived from a diploid ancestor under the influence of hot climatic conditions, having first passed through a stage as a sterile triploid.

The possible economic value of polyploidy in various types of crop plants is mentioned.

246. ZAIKOVSKAYA, N. E. 633.63:576.312.34
(**Morphology of chromosomes of the sugar beet**).
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1935 : **12** : No. 4 : 43–66.

Tests were made first of all on fifteen different fixatives as regards their suitability for revealing the details of morphology of the chromosomes of sugar beet ; the best was one of Levitsky's fixatives containing chromic acid, formalin and mercuric chloride. Intense chilling improved the preparations for the purpose of making counts in root tips with large numbers of chromosomes but for studying the morphology only moderate chilling was permissible.

Examinations of the sugar beet Uladovka shewed that there is no tendency for homologues to be adjacent. The chromosomes are quite small, the longest being 3·43μ and the shortest 1·94μ ; variations of up to 0·5μ were detectable between different plates. The length variation and proportions of the two arms are recorded for each of the nine pairs of chromosomes and the data are tabulated and illustrated diagramatically. The only means of distinguishing the different pairs is by their length and the ratio of the arms ; no satellites or other distinguishing features are present. The ratio of the two arms is a much less variable character than their actual length. Five distinct groups could be distinguished according to length and six according to arm ratio, and by the combination of these two characters eight groups could be distinguished ; leaving therefore only two pairs that could not be distinguished one from the other.

247. 633.63:581.143.26:575.42

CLAUS, E. 633.63:575"793"

Zur Züchtung einer schosserwiderstandsfähigen Zuckerrübe. (**Breeding a non-bolting sugar beet**).

Zbl. Zuckerindustr. 1936 : **44** (3) : 52–54.

In order to select lines free from bolting the sowings are made as early as possible, which causes all plants with a tendency to bolt to do so. Owing to the difficulties of early sowing the seed is therefore sown in autumn, by which means a winter form has been produced. The percentages of bolting in four succeeding generations of this beet are given. The highest line in the first generation gave 77·6 per cent bolting and the lowest 45·5 per cent, the average being 57·3 per cent. The lowest lines were chosen for further breeding and the average in the second generation was reduced to 41·3 in the third generation 21·0 and in the fourth 14·6 per cent, the best lines in this generation having no more than 9 per cent bolters.

A comparison of this winter sugar beet with the corresponding summer beet shews the winter form to be superior also in raw weight, sugar content and total yield of sugar ; non-sugars and water-soluble ash are the same and when sown in spring these lines gave no bolting at all.

Various other treatments designed to stimulate bolting were also tried, comprising various forms of vernalization, and by two repeated applications of the treatment in succeeding generations, accompanied by selection, lines with an average bolting of only 5 per cent were obtained, without any deterioration in respect of other desirable features.

248. 633.63:581.162.5

KHARETCKO-SAVITSKA, E. I. 633.63:575.14

(**Autosterility and autofertility of sugar beet**).

Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1935 : **12** : Nos. 5–6 : 25–44.

The results of self-pollination or isolation of branches in 52 different selected lines of sugar beet over a number of years are tabulated. Even during the first two or three hours after pollination, the germination of self pollen grains on the stigma was seen to be less vigorous than that of pollen grains on the stigma of a different plant. The difference between the two was much more pronounced in some strains of beet than in others, though no strains were found in which no pollen germination at all took place on selfing. On penetrating the tissue of the style the growth of the pollen tubes from self pollen is still further slowed down.

The condition of the embryo sac 3–4 days after pollination, which is described and illustrated, corresponds exactly to that of an emasculated and unpollinated flower. The further course of development of the embryo sac is also analogous to that of an unpollinated flower and is described in detail. The retarded growth of the pollen tubes is thus evidently one of the reasons for the sterility on self-pollination. Fertilization is however occasionally effected, in which case the zygote usually degenerates or ceases growth at various stages of development. A few seeds were formed but were of exceedingly low germinating capacity. The capacity to form viable seeds when self-fertilization has been effected is thus the second main factor in successful self-pollination. In spite of the statements of other observers, no parthenocarpic development of seeds was obtained.

Observations similar to the above were made also on a number of self fertile lines of sugar beet. These were in no way different from the ordinary self-sterile races in the general features of flowering, but the growth of the pollen grains and tubes was much more rapid ; the pollen tube reached the micropyle and penetrated the embryo sac in the first day or two after pollination. Examinations of the progeny of certain self-fertile plants from different stations, consisting of 38 lines in all, shewed differences to exist in the degree of self-fertility ; 10 lines (26 per cent) were classed as highly fertile, with a set of 80–100 per cent on selfing, the high figure of 100 per cent being observed in six lines only. Of the rest of the lines examined, 13 were classed as medium, with 40–80 per cent fertility and 14 as low, from 10 to 40 per cent and one gave no set at all. The average fertility of all lines amounted to 36·4 per cent.

Out of the six lines with 100 per cent self-fertility only one achieved fertilization in the first twenty-four hours, four in the second day and one only on the third day. In these lines, however, the time required for fertilization in the case of out-pollination was the same, except in one

plant where fertilization was effected on the first day when cross-pollinated and on the second when selfed ; in these lines, therefore, self-pollination does not retard the rate of pollen tube development. In all others the rate of growth of self pollen was less than that of foreign pollen, to an increasing extent with diminishing self-fertility of the lines.
Some of the lines, though giving a fairly high set on self-pollination, produced no viable seeds. This again illustrates the independence of the capacities for self-pollination and for forming normal seeds. Self-fertilization frequently results in the segregation of lethal homozygotes and a truly self-fertile form will be obtained only when a genetical constitution capable of tolerating continued inbreeding can be combined with the high capacity for self-pollination.

249. Savitsky, V. F. and Okanenko, A. S. 633.63:581.192:575.11
(Genetic study of biochemical properties of *Beta vulgaris* L.)
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1935 : **12** : No. 4 : 35–42.

Analyses were made of the F_3 of a cross between sugar beet and Eclipse table beet and of the back-cross obtained by crossing the F_2 with sugar beet ($F_2 R_1$), the standard variety used for comparison being Uladovka. The protein content of the F_3 varied from 95 to 125 per cent of the standard while the corresponding variation in the $F_2 R_1$ was 100 to 165. Similarly the salt content varied from 95 to 125 in the F_3 and from 90 to 160 in the $F_2 R_1$. No correlation was detected between salt and protein content, so that by selection any desired combination of these two characters could be effected. As regards sugar content, the $F_2 R_1$ was higher than the F_3 but the sugar content was not correlated at all with either protein or salt content. Thus all these three constituents appear to be inherited independently.
Analyses were also made on $F_1 R_2$ and $F_2 R_1$ lines of the cross sugar beet x Red Obendorf and confirmed the results of the previous cross. Here the variation in protein content in $F_2 R_1$ was from 75 to 135 and in $F_1 R_2$ from 75 to 135, in salt content from 75 to 125 in $F_2 R_1$ and 75 to 165 in $F_1 R_2$. The greater variation in salt content in the lines from the double back-cross is partly explained by the greater number investigated in this case. The segregation of lines with low salt content is of some practical importance.
Again no correlation was observed between salt and protein, protein and sugar, salt and sugar or total nitrogen and sugar content. The correlation of low sugar with high salt content commonly observed in beet varieties does not therefore persist in the hybrids and is thought to be a result of the lines on which the different types of beet have been selected rather than the expression of a genetic linkage. Similarly as regards soluble (noxious) nitrogen, both high and low forms segregated in the hybrids, some of which were no worse in this respect than the ordinary sugar beet.
These studies disclose the possibility of obtaining new combinations of characters and so of effecting quite new lines of improvement not only in sugar beet but in the table and forage types too.

250. *Savitsky, V. F. 633.63:581.43:575.11
(Study of variability and heredity in the weight of beet root).
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1935 : **12** : No. 2 : 3–53.

Observations on the variation occurring in a number of vegetatively reproduced clones have shewn that root weight is one of the most variable of all characters, whilst sugar content is one of the least variable. The degree of variation in root weight however is a genotypical character and some varieties are much less variable than others. Marked differences are also detectable between the varieties in the extent of the correlation between root weight and sugar content ; in some varieties this correlation is reduced almost to zero, a fact of great importance in making selections to combine these characters.
Most of the correlations that are observed in pure bred or clonal material are physiological rather than genetical, as is shewn by comparisons of different varieties, in which the correlations

* A full summary of this paper is on file at the Bureau.

are either very much reduced or disappear entirely. Most of the correlations observed vary with the different directions in which a variety has been selected. When the studies include chards and some of the primitive types of beet that have not been subjected to artificial selection, and especially the wild beets, entirely different correlations are observed in many respects ; in this case there even appears a positive, instead of the usual negative, correlation between root weight and sugar content. This is largely accounted for by the much smaller root size of these more primitive types. All this goes to shew that even the commonly accepted correlations have little validity in breeding work and that the old methods of variation statistics must be superseded by more exact methods and principally by genetical methods.

Owing to the variability, both individual and genetical, of root weight, breeding for it is difficult : the progeny of the highest weighing individuals usually do not maintain the high parental value but differ little from the mean in root weight. In addition to this the prevalence of cross-pollination plays an important part in reducing the value of the progeny of the best plants, combined with the heterozygosity of the races.

The variation was studied in a group of plants from seed obtained by mass selection. The variation coefficient for root weight in 1927 was 41 per cent and for sugar content 7 per cent. The upper and lower variants were selected, namely those weighing 800 grm. and over and those of 150 grm. and under. The difference in the average weight of the progeny of the two groups amounted to only 12 grm.

Crosses were made in different combinations between sugar, forage and table beet and chard. The F_1 plants were grown in pairs or groups in Munerati isolators in order to produce an F_2 which consisted in each case of 400 to 1,500 plants. The yielding capacity of the F_1 hybrids varied very much with the parental combination. Different combinations, all with the same maternal parent but different pollinators, shewed clear differences in weight of root. The combinations with table beet or chard tended to be low and those with forage beet high in root weight. It is not uncommon for the F_1 to exceed both parents in weight, however, even in the crosses with table beet or chard; the hybrids between these two latter types had enormous tops and a large increase in root weight.

Plants with high yielding capacity also occurred in the F_2 of the crosses between sugar and forage beet, some of them exceeding the sugar beet by 30–40 per cent. The hybrids of sugar and table beet mostly gave low yields in F_2. The sugar beet x chard hybrids were variable in F_2 but most of them were low in yield, giving not more than 60 per cent of that of the sugar beet. The hybrids of sugar beet x table beet and chard never exceeded 800 grm., whilst the weight of some of the hybrids with forage beet reached as much as 1,500 grm. and even 1,700. Transgression of the parental limits was of common occurrence, however, in all combinations. Back-crossing the F_1 with the sugar beet reduced the proportion of low yielding forms only in the crosses with a low yielding form such as the table beet and increased it in the crosses with a high yielding form such as forage beet ; however, back-crossing the F_2 or the first back-cross almost always raised the average yield. This is partly due to the fact that back-crossing preserves heterozygosity and prevents the segregation of deleterious genes in the homozygous condition. The fact, however, that forms exceeding the parent segregate in the crosses with forage and with table beet shew that both these forms contain certain genes for yield which are absent in the sugar beet. Their behaviour shews them to be not polymeric but independent genes and by their combination it should be possible to produce strains with still higher yield.

251. Orlovsky, N. I. 633.63–2.112–1.521.6:578.081
(Studies on degrees of drought resistance of sugar beet varieties).
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1935 : **12** : No. 4 : 3–8.

Field tests of a number of varieties shewed that the high yielding types both under normal and under drought conditions were the most productive. A new variety Uladovka was best in this respect under normal conditions whilst the best of the high-sugar varieties was Janaš. Under drought conditions, however, these two varieties were the worst and the varieties Kharkov and Ramon were best of the yield type and Ves.–Podol 723/157 and Kal'nik of the high-sugar type. Similar

results were obtained in pot experiments with high (60 per cent) and low (30 per cent) water content.
The content of dry matter during drought proved to be greatest in the variety Kharkov and least in Janaš and Uladovka, the water contents being presumably in inverse proportions, shewing that as in cereals the water content of the leaves during drought tends to be lower in drought-resistant varieties.
Seedlings were also grown in dishes and left unwatered after the appearance of the first pair of leaves. When 50 per cent of the seedlings had withered up in the standard variety Kharkov, the amount of survival in the other varieties was determined. Expressed as a percentage of Kharkov the survival in the variety X. No. 40 (a selection from Kharkov based on the vigour of the young plants) was 112 and that of Verkhjačka 108 ; other varieties were all below Kharkov, the lowest being Janaš with 86 per cent, and again the sugar types proved less resistant than the yield types. The use of the seedling method of testing for breeding purposes is recommended.

252. Broyakovsky, N. V. 633.63–2.484–1.521.6:575
(Chief rules for breeding beet varieties resistant to silo rot disease and *Cercospora*).
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1935 : **12** : No. 3 : 74–85.

Since little or nothing is known concerning resistance to silo rot, one of the first problems is the choice of suitable parental material. The whole of the material which has been selected on the score of sugar content and root weight is tested for resistance to *Botrytis*, two sections out of each root being examined. As about 70–80 per cent of the roots are discarded as susceptible, it is therefore necessary to increase the scale of the previous selection work in order to have sufficient resistant material for the further stages of breeding. At the Ivanov station 2,000 roots are examined every year and about 1,600 of these are discarded for susceptibility. The 400 selected roots are multiplied vegetatively and tested for resistance again before being planted in isolated groups to obtain seed.
Tests are also made of the super-élite lines but here only the most susceptible are discarded and the 80 per cent resistant and semi-resistant are retained ; the 5–10 per cent plants with the highest resistance are propagated separately, for purposes of seed production, differences in other characters being for the time being neglected. In this way only resistant and semi-resistant lines get to the field test stage. The progenies of different lines are observed in order to select the lines giving the greatest proportion of resistant progeny. By a continuation of this process over a number of years it is hoped that resistant lines will be produced.
The best élite lines are also tested for resistance under silage conditions.
Similar methods are applied to the selection of lines resistant to *Cercospora*, the plants least affected being selected in the breeding plots ; all plants in which less than 40 per cent of the leaves are killed are selected in years of bad attack. Special highly infected moist patches in which infected leaves from the previous year are scattered are also used for testing a certain number of plants from each clone.
Studies have been made of all the available inbred lines in respect of their resistance to both diseases. The most resistant lines are subjected to tests of resistance again after vegetative reproduction, after which their progenies are tested, attention being given both to the average infection and the coefficient of variation in comparison with the parental line, so that the lines most nearly homozygous for resistance can be selected. If the most resistant clones are satisfactory in other features they can serve as pedigree lines and as parents for hybridization ; if they are low in yield they can be used for mixed crossing to raise the yield by heterosis. If their other qualities are unsatisfactory they can be subjected to further selection, as are also highly resistant but segregating lines.
The last stage in the programme is to combine resistance to both diseases. The best *Cercospora* resistant lines are selected also for resistance to silage rot.
The method of making the resistance tests is described in detail.

253. Broyakovsky, N. V. 633.63–2.484–1.521.6:575
(Breeding of sugar beet resistant to silo rot disease).
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1935 : **12** : No. 4 : 67–76.

The author's observations have confirmed those of Shevtchenko (Cf. Abst. 254 below) that tests of two sections are sufficient to determine the reaction of a particular root to the fungus (*Botrytis cinerea*). Tests on a large number of varieties and inbred lines furthermore shewed a close agreement between the reaction of the lines in the laboratory, their reaction under artificial infection and their actual behaviour in the silo ; the laboratory method in fact gave a sharper differentiation of the varieties, since certain types classed as resistant or partially resistant in practice were almost fully infected by the laboratory method ; and those that were classed as resistant by the latter method remained free from infection or shewed at most not more than 3 per cent infection in a silage test lasting 5–6 months, where the average infection was 25·3 per cent.

The method was therefore deemed suitable for use in breeding and in 1933 tests were made of 2076 pedigree lines. The degree of infection varied from 10 to 100 per cent. Taking 2 as a basis of selection 4–5 per cent of the plants would be selected. Clones produced vegetatively from plants representing different degrees of infection continued to shew infections corresponding to those of the plant producing them, both when tested in the laboratory and when artificially infected. Similar results were obtained in tests of 594 inbred lines, the average infection being 88–90 per cent, while certain lines gave only 10–30 per cent. These latter were reproduced vegetatively and the clones obtained from these were also distinguished by high resistance.

Selection on these lines is to be applied both to increase the resistance of the varieties already in cultivation and to produce highly resistant lines suitable for hybridization.

254. Shevtchenko, V. N. 633.63–2.484–1.521.6:575
(Microbiological method of selection of sugar beet as to resistance to silo rot disease).
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) 1935 : **12** : No. 2 : 71–80.

Silage rot caused by *Botrytis cinerea* has received little or no attention so far from breeders. Triangular portions cut from the root, containing part of the top and part of the natural wall of the root, were tested by placing them on a culture of the mycelium of the fungus and maintaining them for 5–6 days at a temperature of 25°C. At the end of this time the degree of infection was determined. Marked differences were observed between different varieties although the correlation between different pieces of the same root was very high. Some varieties, especially the high sugar types, were very uniform in reaction, whereas others shewed wide variation within the variety. The most susceptible group was the fodder group, e.g. Mammoth and Eckendorf ; the sugar and semi-sugar beets were slightly more resistant. Sharp differences were also observed in the resistance of different lines obtained from inbreeding, illustrating the hereditary nature of resistance.

The method described is useful in breeding, since the roots from which the test piece is cut can be used as parents. Thus by making observations on the resistance of the material designed for selection it will be possible to create lines which in addition to possessing the desirable features for which the breeding is carried out, will be at the same time free from the attacks of *B. cinerea*.

255. 633.63–2.8 1.521.6:575
633.63 U.S.33
633.63 U.S.34
633.63 No. 600

New sugar-beet varieties for the curly-top area.
Circ. U.S. Dep. Agric. 1936 : No. 391 : Pp. 5.

By mass selection from the variety, U.S.1, the new varieties U.S.33 and U.S.34 have been developed. They are both more resistant to curly-top than U.S.1, U.S.34 being more resistant

than U.S.33, while the latter has a slightly higher sucrose content. Their reduced tendency to bolting allows planting them earlier in the spring.
Another resistant variety, No. 600, has been developed by the Amalgamated Sugar Co. by hybridization. It has out-yielded U.S.33 and U.S.34 under disease free conditions and under severe curly-top exposures, but is somewhat lower in sucrose content.
Breeding is being continued by the Bureau of Plant Industry with the object of producing still more resistant varieties and of reducing the tendency to bolting.

256. Skuderna, A. W., Price, C., Culbertson, J. O. and Cormany, C. E. 633.63–2.8–1.521.6:575
The curly-top resistant beet variety. Results obtained with U.S. No. 1 in three years' tests have proved its value—acreage increase rapid.
Facts ab. Sug. 1936 : **31** : p. 17.

Tests from 1932–34 have shewn the superiority of the curly-top resistant variety U.S. No. 1 under epidemic conditions, outyielding the commercial brands by four or more tons per acre in years of severe outbreaks of the disease. Under non-epidemic conditions the yield for U.S. No. 1 was somewhat less than the commercial varieties, though on the average satisfactory. In percentage of sucrose in the beets and apparent coefficient of purity U.S. No. 1 was quite equal to the commercial varieties with which it was tested. (Cf. " Plant Breeding Abstracts " Vol. IV, Abst. 210.)

STIMULANTS 633.7

257. Paguirigan, D. B. and Ramos, J. C. 633.71:575.125
Utilization of first filial generation hybrids in crop improvement with special reference to tobacco.
Philipp. J. Agric. 1936 : **7** : 59–86.

The F_1s of the crosses Samsoun Bafra x Conqueror, Conqueror x Big Warne, Big Warne x Samsoun Bafra, Samsoun Bafra x Orinoco, Orinoco x Big Warne, and Conqueror x Orinoco were compared with their parents in respect of height of plants, number of leaves, breadth index of leaves, average yield per hectare and period of maturity. They shewed increases over the average of their parents for height of plant, number of leaves and yield and were always earlier in maturing or flowering than either parent. Certain of the hybrids excelled both parents in height of plant, number of leaves or yield. The breadth index was intermediate in three cases and less than either parent in the other three.
As a result of the experiments, trial plantings of F_1 hybrids of cigarette tobacco are recommended ; it is emphasized that the parents must be of superior varieties and possess identical or nearly identical characters.

258. Eghis, S. A. 633.71:575.129:575.127.2
[**Interspecific hybridization in *Nicotiana*. IV. A new type of the fertile hybrid, *N. Tabacum* x *N. sylvestris*. (Contribution to methods of introducing chromosomes of other species of *Nicotiana* into the genom of *N. Tabacum*).**]
Bull. Appl. Bot. Leningrad 1935 : (1936) : Ser. II (9) : 131–52.

By means of a number of crosses between forms of *N. Tabacum* × *N. sylvestris* it was found possible to introduce some of the chromosomes of *N. sylvestris* into the genom of *N. Tabacum*.
In proof of this some of the progeny had the recessive white corolla colour of *sylvestris* and some had the characteristic odour.
The progeny were all fertile in spite of chromosome numbers ranging from 48–53.
Further experiments to decide whether the exclusion of the *Tabacum* chromosomes leads to any decrease in the vitality of the plants are to be undertaken.
For practical purposes, some of the hybrids yield a tobacco of exceptional fragrance due to a combination of the chemical characters of *Tabacum* and *sylvestris*.

259. PÉREZ, R. 633.71:575.42(72.91)
La selección de la semilla de tabaco. (**Seed selection in tobacco**).
Rev. Agric. Habana 1936 : **19** (2) : 159–64.
Comment is made upon the mixed nature of the Cuban tobacco plantations and the disadvantage that this entails. Four distinct varieties are grown and these have produced innumerable hybrids by natural cross-pollination. The best of these varieties is the *Havanensis*, which has been the object of much successful selection in the past; the others are inferior to it in various respects. To maintain the Havana type pure it is necessary that rigid selection be applied to all seed material and directions for carrying this out are given.
The state Department of Agriculture also carries out the work of selection on this variety with the object of supplying seed of it to replace all the others.

260. SZTEYN, K. 633.71:576.341:575
Pomiary siły ssania ziarna tytoni uprawianych w Polsce. (**Suction force measurements in tobacco varieties**).
Roczn. Nauk Rol. 1936 : **36** : 349–68.
Among the conclusions reached is the finding that suction force is mainly a varietal character, which is high in pedigree fine varieties and lower in common varieties of an inferior grade. The large-leaved varieties shewed a low suction force, which agrees with the view that such types are unsuited to dry regions.

261. OLMO, H. P. 633.71:576.356.4:576.354.4
Cytological studies of monosomic and derivative types of *Nicotiana tabacum*.
Cytologia, Tokyo 1936 : **7** : 143–59.
A report on the cytology of the monosomics whose origin and genetical behaviour were described in an earlier paper (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 224).
At the first metaphase of meiosis the monosomics usually shew $23_{II} + 1_I$; while the univalent has no definite position in respect of the equatorial plate, it is most frequently on or near it. The univalent divides at late anaphase and the halves move towards their respective poles, often failing to reach the interkinetic nuclei. At the second division the most usual condition is one in which they lag between the poles without dividing. The young pollen grains often contain micronuclei and a certain proportion of microcytes is also formed.
Irregularities observed in the monosomic plants themselves included fragmentation of the univalent, trivalent formation and disturbances of the pairing of other chromosomes, possibly due to competition by the univalent during synapsis.
For comparison, the cytology of a pure line strain of *N. Tabacum* var. *purpurea* was studied for irregularities. Meiosis was in the main regular, but chromosome elimination by microcytes and micronuclei, was found to an extent estimated to produce about 4 per cent of pollen grains with unbalanced chromosome numbers; about 97 per cent of good pollen was found in these normal plants.
The cytology of the aberrant types obtained in the progeny of monosomics (Cf. " Plant Breeding Abstracts " loc. cit.) was also studied and they were found to comprise trisomics, plants with one or more fragments, plants with irregular pairing and with various multivalent groupings and triploids.
The occurrence of aberrant types in the progeny of monosomics in other plants is discussed, as illustrating the genetical unbalance created by this condition.

262. KOSTOFF, D. 633.71:576.356.5:575.127.2
Polyploid hybrids *Nicotiana rustica* var. *texana* L. x *Nicotiana glauca* Grah. (A preliminary report).
Bull. Appl. Bot. Leningrad 1935 : (1936) : Ser. II (9) : 153–62.
The F_1 hybrids of the cross *N. rustica* var. *texana* × *N. glauca* are described. The cross with *N. rustica* var. *humilis* was unsuccessful.

The reduction division shewed the " Drosera " type of conjugation but trivalents and multivalents also occurred. About 3–8 per cent of giant pollen grains were formed. The F_1 was self-sterile but plants were obtained by first selfing and then pollinating with *N. rustica* vars. *humulis* and *texana*.
A cytological examination shewed that these were chiefly triploids and aberrants with 48–70 chromosomes.
Two amphidiploids with 72 2n chromosomes and one pentaploid with 96 chromosomes were found. The amphidiploids were dwarfs.

263. Ternovsky, M. F. 633.71:576.356.5:575.127.2
(Interspecific hybridization in *Nicotiana*—occurrence of polyploid and haploid plants).
Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 125–30.
In 1931 there appeared among a large number of sterile hybrids of *N. Tabacum* (n = 24) x *N. glauca* (n = 12) three plants with well filled capsules which produced seed for an F_2 generation. The plants themselves were preserved vegetatively. A further three similar plants were found in 1932 ; one of these six plants proved to have 36 somatic chromosomes and to have a highly irregular meiosis ; it formed a relatively high proportion of unreduced pollen grains however and this evidently accounts for its fertility. Three other plants had 60 somatic chromosomes evidently having arisen from an unreduced *N. Tabacum* and a normal *N. glauca* gamete. The meiosis in these plants was much more regular but seeds were obtained only with difficulty from self-pollination. Abundant seed was set on pollinating with the parental species. The fifth plant seemed to be a chimaera containing triploid tissue with 36 and hexaploid with 72 chromosomes. It was also entirely self-fertile. No observations were made on the sixth plant.
The F_2 generation from these fertile plants shewed segregation as regards anthocyanin, which which is present in *N. glauca* and absent in *N. Tabacum*.
Two plants were obtained in 1931 from the cross *N. rustica* (n = 24) x *N. glauca*, a cross which has not been achieved by previous investigators ; two further plants were obtained in 1932. Seed was obtained from them by free pollination and crossing with the parental and other species. The hybrids were exceedingly large and vigorous and had irregular meiosis.
Both these crosses with *N. glauca* are of practical interest because of the hardiness and immunity to virus diseases of this species.
From a large number of crosses between *N. Tabacum* and *N. Sanderae* (n = 9) seven hybrids were obtained. From free pollination and back-crossing one plant produced seed, and also one capsule from self-pollination. Preliminary aceto-carmine examinations indicate that the plant has two *Tabacum* genoms and one *Sanderae* genom. Such hybrids are of interest on account of their immunity to *Oidium*.
In the cross *N. glutinosa* (n = 12) x *N. Tabacum* in 1932 three fertile hybrids were found, all being fully fertile even on bagging ; they were also fertile with the parental species and others. They resembled the sterile hybrids of the same combination but were larger. One of the plants bore one fertile and one sterile branch and the fertile branch proved to have the double chromosome number 72, with 36 bivalents at metaphase. The second plants was entirely amphidiploid with 72, while the third, though completely fertile, seems to have only 36. The interest of this combination again is its complete immunity to *Oidium*, derived from the *N. glutinosa* parent.
Two haploid plants were obtained, one from the cross *N. Tabacum* x *N. glauca* and the other from *N. Tabacum* x *N. congiflora*, the maternal parent in each case being the variety American 572. The haploids were small but in all other respects similar to the maternal plant. They flowered abundantly but were sterile, having the somatic chromosome number 24.

264. Krug, C. A. 633.73:576.312.35
Estudos cytologicos em *Coffea* II. **(Cytological studies in *Coffea* II.)**
Bol. Tech. Inst. Agron. São Paulo 1936 : No. 22 : Pp. 5.
In continuation of the previous work (Cf. " Plant Breeding Abstracts," Vol. VI, Abst. 612) chromosome counts were made of eleven further varieties of *C. arabica*, all of which had 2n = 44. In form and size the chromosomes were identical with those previously studied. However, a

variety *C. arabica* var. *Ballata* Cramer morphologically somewhat distinct from the other varieties studied, revealed polyploid chromosome numbers, both 2n = 66 and 88 being observed. Four other species had 2n = 22, namely *C. abeokutae* Cramer (*C. excelsa*), *C. Dybowski* Pierre ex De Wilde, *C. Dewevrei* De Wild (*C. excelsa*) and *C. Ugandae* Cramer (*C. robusta*).
The basic chromosome number 11 for the genus seems to be therefore definitely established.

265. 633.73:581.483:575.1
633.73:581.47
HOUK, W. G.
The ovule and seed of *Coffea arabica* L.
Science 1936 : **83** : 464–65.

On investigating the vascular anatomy of the flowers of *Coffea arabica* L. the ovule was found to have no integument and in addition the endosperm was found to be evanescent, being scantily developed in the embryo and disintegrating as the embryo enlarges so that the mature seed has no endosperm.
What has hitherto been termed the endosperm is in fact the perisperm, and it is the nucellus which enlarges to form the nutritive tissues round the embryo.
The importance of these findings in the study of the inheritance of endosperm characters is evident.

266. KADEN, O. F. 633.74:575.42
Richtlinien für die Veredlungs- und Resistenzzüchtung im Kakaobau. (**Guiding lines for breeding for quality and resistance in the cultivation of cacao**).
Tropenpflanzer 1936 : **39** : 203–10.

In continuation of the work already reviewed in " Plant Breeding Abstracts " Vol. VI, Abst. 614 the author considers the problems that confront firstly the grower of criollo and secondly the grower of forastero. In the first case selection need only be made of trees with fruit of the requisite shape, thin shelled and with a low degree of astringency of the seeds as well as for disease resistance.
The second case requires more detailed selection and where possible a replacement by criollo is advised but if criollo cacao cannot be grown, hybrids between the two may be of value. Seeds are best germinated and grown in separate little baskets and layering is the only successful way of vegetative propagation.

OIL PLANTS 633.85

267. 633.85–1.524.4
[The plant resources of the world as initial material in plant breeding. (Botanic-ecological and economical characteristic). No. 6 Oleiferous plants].
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Moscow and Leningrad 1935 : Pp. 119.

In this collective work the different plants are dealt with individually as follows :—
F. S. Ventslavovič. *The sunflower* (*Helianthus annuus L.*). (*pp. 5–39*).
The species *Helianthus annuus* is divided into three subspecies, consisting of the wild, the ornamental and the cultivated (oil and edible) types, all of which are described, with several subtypes in each. The question of resistance to various pests and diseases such as the moth *Homeosoma nebulella*, rust, *Sclerotinia* and *Orobanche* is discussed and forms possessed of resistance in various degrees are mentioned. Forms resistant to the virulent race B of *Orobanche cumana* for instance have been found in the Ukraine and the Voronesh district. Descriptions are given of a large number of varieties and forms from different parts of the U.S.S.R. and from other countries, with remarks on such important characters as time of maturity, oil content, amount of branching (unbranched forms being the most desirable) and the presence or absence of the layer of dark coloured cells in the seed coat, determining the resistance to moth and largely also to *Orobanche* and to rust. In addition to the oil forms certain edible types are also described. A key for the determination of the different types is provided and illustrations are given of the main forms.
The U.S.S.R. contains a rich fund of material of the sunflower and thanks to this one of the most

difficult and important problems in sunflower breeding has already been solved ; namely immunity to disease ; the production of forms resistant to the B race of *Orobanche* was done directly by selection from unpedigreed local populations. However, for the solution of further problems such as drought resistance, self-fertility, rust resistance, perennial habit, etc., it will be necessary to have recourse to other groups such as the wild and ornamental forms and even other species of *Helianthus*. The ornamental sunflowers are in nearly all respects intermediate between the wild forms characterized by large numbers of relatively small branches, inflorescences, seeds etc. and the cultivated forms, characterized by much greater size and smaller number of all these organs; they represent as it were a stage in the evolution of the cultivated from the wild type. The wide segregation occurring on crossing the wild and cultivated forms shews how far this evolution has gone during the few centuries since the introduction of the sunflower into Europe. In view of this, and of the probably limited nature of the first introductions, there seems to be no limit to the possibilities of sunflower breeding when the whole of the wild and cultivated forms are utilized, and great possibilities are foreseen from the use of the cultivated and ornamental forms alone, if these are subjected to inbreeding, hybridization, etc. followed by selection.

E. A. Elladi. *Ecological types of flax.* (*pp. 41–53*).

The extent of the area over which flax is cultivated has led to the development of a variety of widely different ecological types, within each of which further differences exist in respect of important industrial characters. Thus oil content varies from 32 to 47 per cent, the weight of a thousand seeds from 2·7 to 13 grm. ; great variation also occurs in the branching and height of stem in the length of the different developmental stages and of the total vegetative period, and in resistance to the main flax diseases. Examinations made at the Institute of Plant Industry have made it possible to establish 23 different ecological types and these are described, pointing out the valuable breeding features or defects of each and a key is given for their determination.

V. M. Hil'tebrandt. *The castor oil plant* (*Ricinus communis L.*) (*pp. 55–70*).

All the many forms of the castor oil plant are interfertile and are united by intermediate forms and are regarded therefore as belonging to one species. G. M. Popova has, however, established four subspecies. The most ancient of these, characterized by the predominance of hereditarily dominant characters, is found in Abyssinia and Eritrea and the bordering regions of Africa and Asia and from this the forms now existing in more distant countries have apparently evolved. In the more northern countries evolution has taken the form of an increase in earliness without great change in type, whilst in the countries bordering on the centre of origin a great variety of plant types have developed.

The various subspecies and their subtypes are described, and their merits are pointed out, starting with the Persian type, which is the most productive in the U.S.S.R., and has the advantage of producing one large main inflorescence. However, every geographical area, from the equator as far as latitudes of 50° N., has its own characteristic forms which in the particular conditions of their local habitat are the most productive. The Chinese type is also recommended to Soviet breeders and the Indo-African and Zanzibar types possess certain characters which also merit attention in breeding for special features, though their genetic relationship with the two former species remains a matter for study.

A key is given for the determination of the varieties.

Z. Luzina *The groundnut* (*Arachis hypogaea L.*). (*pp. 71–80*).

The different types of groundnut are described on the basis of the world collection of the Institute of Plant Industry. The number of varieties is very limited and the only ones of use to the Soviet Union are the more early maturing American sorts of the bunch type. The main problem for Soviet breeders is the production of earlier forms with high yield and uniform ripening, capable of growing in more northerly regions than the limited zones where groundnut is at present cultivated. Further problems are to increase the oil content, reduce the percentage of shell, to produce an erect form with firmly attached pods suitable for mechanical cultivation and possibly also to raise both the oil and protein content in the same line. Resistance to pests and diseases, in particular *Fusarium*, is another important line of breeding. In view of the small amount of variation existing in the available material the solution of these problems will probably require hybridization, both intra- and interspecific, in order to increase the range of variation and number of character combinations.

M. A. Veselovskaja. *Poppy (Papaver somniferum L.) (pp. 81–95).*

The collection of poppies has been sown in a number of different parts of the Soviet Union and examined botanically and agronomically. Seven subspecies of *Papaver somniferum* have been established and are described.

Soviet breeders are recommended to give attention to the following points in breeding the poppy for oil purposes: (1) disease resistance, especially to *Peronospora arborescens* and *Fusarium* and also *Alternaria brassicae*; certain forms are known to be at least partially resistant to *Peronospora*, e.g. the blue poppy v. *griseum*, subspecies *eurasiaticum*; (2) thin capsule walls in the case of regions where rain falls round about the time of maturity, so as to prevent excessive water retention and consequent sprouting of seeds; (3) good development and number of capsule septa, increasing the yield of seeds; (4) large size and small number of heads, which makes for high yield; (5) uniformity of ripening, which is also favoured by a small number of heads per plant; (6) high oil content, which seems to be correlated with white or yellow seed colour and also with bluish-grey colour. The forms most widely cultivated in the U.S.S.R. are described and their merits and defects recorded; a chart is also provided shewing the occurrence of different characters in the different races. In view of the great variety of these forms much is to be expected from selection and still greater possibilities may be expected from hybridization between geographically distant lines when this is tried.

V. M. Hil'tebrandt. *Sesame (Sesamum indicum L.) (pp. 97–119).*

Observations have been made on 550 different specimens of sesame from the point of view of their value for breeding and descriptions are given of the different types and of their behaviour in the U.S.S.R. In this way those suitable for breeding in the Soviet Union are indicated. For the North Caucasus the main desiderata are early maturity and resistance to bacterial infection; the only individuals possessed of these qualities to the requisite extent are the Manchurian forms and as the range of variation of these forms is distinctly limited, hybridization, probably with distant geographical races, will be necessary in order to evolve the desired types. The same is true for the Ukraine, the Volga basin, the unirrigated areas of Transcaucasia and other parts of the U.S.S.R. where the growing season is short.

In central Asia, the main sesame growing zone of the U.S.S.R., there already exists a great variety of forms. The thin-stemmed forms from Bokhara, Afghanistan and other districts are the most promising for breeding, and by crossing with other races it is hoped to remedy their main defects which consist in a tendency to shedding, susceptibility to disease and dark colour of the seeds. A chart is given shewing the distribution of a number of agronomic characters in the various geographical races; and a key for the determination of the varieties is provided.

268. Bakhtadze, K. E. 633.854.56:575

(On tung breeding).

Soviet Subtropics 1936 : **6** (22) : 19–34.

The material used was obtained from 5-year old plantations of *Aleurites Fordii* from China, and some material of American origin as well as 5- and 25-year old plantations of *A. cordata* of local seedlings, 35-year old plantations of the same species from Japan, and local seedling material in the second stage of multiplication.

Owing to the mild winter of 1934–35 the young and full grown trees could be tested only for comparative cold resistance under such conditions. The degree of cold resistance was less in the 1–5-year old trees of *A. cordata* but increased subsequently as the trees grew older. Trees of *A. Fordii* up to 5 years of age were also subject to injury. In the season most fraught with danger, the spring frosts, *A. cordata* proved less susceptible to injury as its reproductive period is shorter than that of *A. Fordii* and occurs at a time of year when frost is generally absent.

The biology of flowering and fruiting, leaf formation, pollination (including the role played by insects and the wind), and the various sex phenomena and their relation to age are fully described with data on the number of flowers found in the "cluster" and "single" types of inflorescence. Male trees formed only about 3 per cent of the total population of the plantations and need not predominate in any well planted stand.

Inter- and intraspecific crosses were made with *A. Fordii* and *A. cordata*, totalling 3,746 in all and the best set was obtained from the intraspecific crosses in *A. Fordii*, while the lowest percentage set was recorded for the hybrids of *A. cordata* with *A. Fordii*. Artificial self-pollination of *A. Fordii* gave an average set of 29·43 per cent, i.e., a third of the set obtained by crossing, whilst *A. cordata* selfed gave a set of 45·88 per cent—though considerable variation was observed depending on the varying capacity for self-pollination of the individual trees.

Considering young trees of the same age, *A. Fordii* proved superior to *A. cordata* not only in the average per fruiting tree, but also in the percentage yield for trees in bearing. The average yield from the full grown *A. cordata* trees was from 13–32 kg. with a maximum of 108·9 kg., whilst 34–35 year old trees gave an average of from 4–6·5 kg. yield which can be considerably increased by intensive methods of cultivation.

Injury in the winter or spring accounted for many of the trees of both species bearing no fruit, but all the non-yielders among the full-grown *A. cordata* trees had suffered no injury but were monoecious individuals with male inflorescences predominating. Although all yielded a small amount of fruit in 1934 (6·56 kg. per tree), in 1935 they all bloomed.

Among the causes of failure to set fruit is the periodicity which is a feature of the reproductive process in the tung tree, i.e., the tendency for a tree that has borne particularly well one year to set little or no fruit the next. This characteristic is found in particular in the female trees and those monoecious ones in which female inflorescences predominate.

The yield from female tung trees is higher than that from monoecious trees, a difference which is more clearly seen in the full grown individuals than in the younger ones.

The individual yield is also determined by the type of fruit cluster, the " single " type producing much fewer fruit than the " cluster " type.

Statistics are also given of the yield of seed and its weight and dimensions, the weight of the fruits and their locular structure.

The highest quality fruits were obtained from intraspecific crosses of *A. Fordii* and of *A. cordata*. Inferior fruits resulted from the self-pollination of *A. cordata* or from crosses of this species with *A. Fordii*.

The seed from self-pollination of *A. Fordii* and *A. cordata* germinated well, producing normally developed seedlings ; while the fruits obtained from *A. cordata* × *A. Fordii*, though smaller than normal, also produced normal seed and seedlings.

Pollination of *A. Fordii* by *A. cordata* yielded very good fruits as regards size and weight, also being even superior in quality to the intraspecific hybrids ; the " single " type was, however, used in this cross. The germination capacity of the seed and the quality of the progeny have not yet been determined.

In concluding the report with a classification of tung tree races according to the characters that have been discussed, it is stated that the late ripening races are generally the heaviest yielders.

MEDICINAL PLANTS 633.88

269. Appl, J. 633.88:575(43.72)

Anbauversuche mit Arzneipflanzen bei der landwirtschaftlichen Landesversuchsanstalt in Brünn im Jahre 1934. (**Culture experiments with medicinal plants at the Agricultural Experiment Station in Brünn in 1934**).

Verlautb. dtsch. Sekt. mähr. Landeskulturrat. 1935 : **36/12** : No. 4 : 66–72.

The author gives the 1934 results relating to the study of cultural methods, yield, inheritance studies and the possibility of cultivation of various medicinal plants. A large number of plants are being used in the work of this Station, including various species of mint, of thyme and also *Chenopodium*, lavender, etc., etc. The paper gives details of the results obtained up to the present. In general certain species appeared worth cultivation while others did not. A.B.

RUBBER PLANTS 633.9

270. KUPTSOV, A. I. 633.913:575

(Tau-saghyz as an object of breeding).

Bull. Appl. Bot. Leningrad 1936 : Ser. A (17) : 103–20.

The new species *Scorzonera tau-saghyz* discovered in the plateau of Kara-Tau contains 20–30 per cent of rubber in the latex. The plant is a typical xerophyte and its physiological characteristics are described in some detail. Though the plant is a cross-pollinator and gives normal seeds by that method, the preculiar conditions of Kara-Tau cause it to be reproduced mainly vegetatively.

The first problem that the breeder has to solve in improving tau-saghyz is to produce a plant of regular growth that can be subjected to the normal cultural measures, the second is a substantial increase in the rate of growth, especially of the roots. After that an increase in the seed production and the selection of types with shorter and thicker roots will also be desirable. The material so far collected shews considerable variation in ecological and other characters, such as leaf form, time of flowering, rapidity of growth and the proportion of plants which perish under conditions of field cultivation. The latter character varied in different families from 18 to 100 per cent. The selection of the types giving the least losses is the first and most important step in breeding. This can be partly achieved by merely growing them in the field and utilizing natural selection. As regards growth rate some forms are twice as fast as others ; most forms have the undesirable character of summer dormancy, but about 10 per cent of the forms found remain green throughout the summer and it is thought that selections from among these will materially increase the rate of growth.

The rubber content varied under conditions of cultivation from 4 to 24 per cent during the second growth season ; the forms from different regions were different in this respect, that from Djelagan-Ata being the highest. These will be used for hybridization when forms with all the other desirable features have been produced.

The most rapid-growing plants are also the first to flower, usually in the second year ; others may flower only the third or even fourth year or later ; the evergreen forms also tend to flower early. Great variation is seen in the number of inflorescences, their size and the yield of seeds.

The root form varies from cylindrical to almost conical.

Plants grown from seed collected from a population grown under conditions of field cultivation already shewed an improvement in rapidity of growth and of flowering and nearly all remained green throughout the summer, shewing the rapid effect of natural selection. This combined with the fact that annual species are known in the genus *Scorzonera*, suggests that selection in the above directions ought to meet with every success. One of these species, *S. hispanica*, is also very vigorous in growth, of the cultivated type, and has a large swollen root. It will probably be useful for hybridization. The same applies to *S. Szontzii*, which has the further advantage that the thickened portion of its root grows above ground. An important factor to be taken into consideration on using these species for hybridization is that *S. tau-saghyz* is peculiar in having a very large proportion of phloem and latex tissue in comparison with xylem and in having the former irregularly mixed up with the latter.

S. tau-saghyz, *S. hispanica* and *S. acanthoclada* (a promising species on account of its large seed capsules and seeds) all have seven haploid chromosomes, *S. tuberosa* has six.

FRUIT TREES 634

271. OETTINGEN, H. VON 634:575.127

Die Zuchtmethoden I. W. Mitschurins. **(The breeding methods of I. V. Michurin).**

Pflanzenbau 1936 : **12** : 477–82.

A succinct and useful outline of the various new principles evolved by I.V. Michurin and exemplified in his work on distant crossing in fruit trees. The works referred to have been reviewed in earlier numbers of " Plant Breeding Abstracts," (e.g. Vol. V, p. 376).

272. NEBEL, B. R. 634:576.312.32
Cytology and fruit breeding. III. The preparations a fruit tree makes to get the right chromosomes into its seeds.
Fm Res. Quart. Bull. N.Y. Agric. Exp. Sta. 1936 : **2** (3) : p. 6.
Chromosome and gene behaviour are described in simple language and illustrated with reference to the peach-nectarine cross.

273. 634–1.524.4(47)
KOVALEV, N. V. 634:551.566.3:575
(The plant resources of fruit trees in the far east and their significance).
Bull. Appl. Bot. Leningrad 1936 : Ser. A (18) : 21–38.
Within the far eastern zone of the Soviet Union some very remarkable plant resources are to be found. For instance there occur the Ussurian pear and Ussurian cherry, the Siberian and Manchurian apples and the Manchurian apricot, all capable of withstanding temperatures down to –40 and –50°C., thus hardier than any other known form of these particular plants in any part of the world. Hybrids have already been obtained of *Prunus ussuriensis* with *Cerasus Besseyi*, *C. tomentosa* with *C. Besseyi*, *P. ussuriensis* with the hybrid (*C. Besseyi* x *P. salicina*), *Pyrus ussuriensis* with various common pears, and similar hybrids have been produced by Michurin and others, shewing the value of these forms for breeding for hardiness. Some of the hybrids of *Prunus ussuriensis* with North American species are characterized by extreme winter-hardiness and this species is regarded as particularly promising for hybridization. The same applies to the far eastern apricots *Armeniaca sibirica*, *A. manshurica* and *A. Davidiana* and also the local cultivated apricot *A. vulgaris* and its hybrids with the former species. Some of these cultivated forms bear prolifically in zones where the average January temperature is -23·5°C. and often falls to —45°C. Some of the specimens of *A. manshurica* found have quite large fruits with relatively good flavour. *A. sibirica* has been seen to withstand a temperature of —52°C. Since these various species grow side by side on the hillsides, hybridization between them is common and the local populations as they stand afford quite a promising basis for selection. Hybrids have also been produced from them with *Prunus ussuriensis* and crossing with the almond is being undertaken, with the object of producing an almond for the north.
The Chinese cherry, *Cerasus tomentosa*, is equally hardy and equally promising for breeding. It has been crossed with a great number of other cherries and even with *Prunus cerasifera*. An extremely hardy hybrid has been produced between *C. tomentosa* and *C. Besseyi* and will be used for further crossing with other species. Attempts are also to be made to cross *C. tomentosa*, or its hybrid with *C. Besseyi* with a number of other hybrids and with the wild species *C. Maximoviczi* and *C. sachalinensis*. *C. japonica* is also an extremely hardy species, and still more so is the Mongolian species *C. humilis*. Crosses between *C. japonica* and *C. tomentosa* have so far been unsuccessful. In addition to the two above mentioned wild species, *C. serrulata* also occurs, and all are of interest for hybridization. Various species of the genus *Prinsepia* are also thought to be of possible interest for the same purpose.
The cultivated pears of the far east are derived from *Pyrus serotina*, *P. ovoidea* and *P. ussuriensis*. All these are of interest for hybridization, the first two being resistant to scab. Hybrids of southern pears with *P. ussuriensis* have given hybrids which in hardiness surpassed the typical northern forms.
Two species of apple occur, *Malus sibirica* and *M. manshurica*, the former tolerating temperatures down to —55–56°C. There is a great variety of forms as regards morphological features, fruit form and colour, etc. In no case, however, have hybrids, either of the first or second generation, with satisfactory fruit characters been obtained from these species, even by Michurin, and the use of certain naturally occurring hybrids rather than of the pure species is recommended. The species *Micromeles alnifolia*, closely related to the *Malus-Sorbus* group, is also found and might be of interest for hybridization. Similarly there appear forms of *Crataegus pinnatifida* with large fruits of pleasant flavour, also promising for hybridization with *Sorbus* and *Amelanchier*.
As many as thirty-seven species of *Vitis* and thirteen of *Ampelopsis* occur in eastern Asia and two of these are found in the far east of the Soviet Union, namely *V. amurensis* and *V. Thunbergii*. The former species is present in remarkable profusion and variety, which indicates that this

region is close to the centre of origin of this interesting species, which is capable of tolerating −55°C. in winter and + 30°C. in summer. Some of the forms contain up to 20 per cent sugar and over in the fruits. They cross successfully with *V. vinifera* and *V. silvestris* and hybrids with well-flavoured sweet fruits have already been obtained with the former. *V. amurensis* is thus regarded as a very promising parent for breeding northern grapes.

Two species of *Actinidia*, *A. arguta* and *A. kolomikta*, are found with large edible fruits of good flavour, containing 9·3 per cent of sugar; there exists a great variety of these fruits and they are to be used for crossing with *A. chinensis*, which has larger fruits but is not so hardy. The fruits are valuable on account of their unusually high vitamin content.

Juglans manshurica is quite unaffected by −50°C. and is a valuable species for hybridization; it has already been crossed with *J. regia*. *J. cathaenis* and *J. sinensis* are also of interest. *Corylus heterophilla* and *C. manshurica*, both bearing edible nuts, are of value on account of their frost resistance and general hardiness.

Very productive and attractive hybrids, with excellent flavour, have been obtained from a cross between the common red currant and *Ribes dikusha*. Promising forms have also been obtained by crossing these hybrids with another eastern Siberian species, *R. nigrum*; these hybrids are perfectly hardy and of excellent quality, though somewhat acid. Seven endemic species of *Ribes* occur; *R. procumbens*, growing half covered with moss, is resistant even to 60°C. of frost. It is in character intermediate between *Ribes* and *Grossularia* and should be used for crossing with both. *R. Palczewskii* ripens in June when all the other currants are only beginning to flower, whilst *R. manshuricum* is exceedingly late in maturity (late September or even October). Other promising species for breeding are *R. atropurpureum*, with exceptionally large fruits, the dicœcious *R. Maximowiczianum* and *R. triste*, the hardiest species of all. *Grossularia burejensis* is the hardiest known species of that genus, tolerating −50°C. and lower.

The local strawberry, *Fragaria orientalis*, with diploid chromosome number 28, sometimes produces quite large fruits, is productive, disease resistant, very hardy and hence is being much used for breeding. It crosses easily with *F. elatior* (2n = 42), giving pentaploid hybrids with 2n = 35. *Rubus crataegifolius*, one of the local raspberries is not fully hardy and is of low fruit quality. It has 28 diploid chromosomes, as opposed to all the other numbers of the subgenus *Idaeobatus*, which have 14.

Another edible species found in the far east is *Lonicera edulis*, with fruits of unusual but pleasant flavour, ripening early, at the beginning of June, possessed of extreme frost resistance and capable of growing on water-logged ground.

From the above it is seen that the flora of the far east of the Soviet Union is of unique interest for breeding for northern zones. A list of the species of interest is given.

274. 634.00.15(47)
634:575(47)

Odintsov, V.

(Results of the work of the Michurin Horticultural Institute for 1935 and the programme for 1936).

Naučnoe Plodovodstvo (Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow. I.V. Michurin) 1936 : No. 1 : 3–17.

Studies of the varieties most suited to different areas have shewn the superiority of a great many of Michurin's varieties, the most promising of which are mentioned for the different fruits. The behaviour of the Michurin varieties at over 500 different places in the Soviet Union was observed. In addition to a number of general agricultural matters, Michurin's work on the production of new fruit varieties has been continued. Hybridization has been carried out on a mass scale of pear and apple with *Sorbus*, from which very promising seedlings have been obtained.

In the programme for the next working year emphasis is laid on the severely practical side of the work, which principle is to be applied, *inter alia*, to the testing of new varieties, which are to be described less from a morphological point of view than from the point of view of their success under particular conditions of cultivation, with special attention to yield and winter hardiness. For the most northerly areas breeding work will be continued on Michurin's lines of distant hybridization, including the *Sorbus* crosses above referred to; for central regions the main attention will be directed to the improvement of pears and plums and for the south to the improvement of summer apples.

275. Veh, R. von 634.1/2:581.143.7:578.08
Eine neue Methode der Anzucht von Sämlingen, unabhängig von Ruheperioden und Jahreszeit (bei Äpfeln, Birnen, Quitten, Pflaumen, Kirschen). [**A new method for the raising of seedlings, independent of the rest period and time of year (of apples, pears, quinces, plums, cherries)**].
Züchter 1936 : **8** : 145–51.

The method consists in removing the seed coat and the nucellus from the freshly harvested seeds and then leaving them at room temperature covered in tap water in Petri dishes for 5–6 days. They are then gradually transferred, by way of floating pieces of cork on water, to a mixture of half sand and half peat and transplanted as they grow, the weaklings being discarded. By this means seedlings are obtained in 8 months which in physiological development correspond to seedlings of 20 months.

276. Wilcox, A. N. and Angelo, E. 634.11:575.11.061.6
Apple breeding studies I. Fruit color.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 108–13.

Observations on fruit colour were made at the University of Minnesota Fruit Breeding Farm on 1,709 seedlings, representing 24 different parental combinations.

With respect to the percentage of seedlings with red or red-striped fruits most of the progenies fell into three classes, 97 to 100 per cent, 72 to 83 per cent and 48 to 53 per cent, those in the second group gave a good fit to a 3 : 1 ratio and those in the third to a 1 : 1 ratio. It appears that Okabena, Oldenburg and Delicious probably carry a single main gene for red stripes while King David, Jonathan, Winesap, Wealthy and Wolf River probably carry polymeric genes for red.

The cross Oldenburg x Grimes Golden gave a much higher proportion of red striped seedlings than the reciprocal cross. In other reciprocal crosses no such differences were observed.

The progenies with the largest percentage of dark and very dark red fruited seedlings were those having King David, Jonathan, Wealthy or Winesap as parents.

277. Lantz, H. L. 634.11:575.12
Apple breeding: an example of parental prepotency in two progenies of the Delicious apple.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 10–12.

Whereas the Russian variety Antonovka gave a high proportion of vigorous, large and valuable trees in crosses with Delicious, the variety Black Annette gave only a small proportion of valuable trees in crosses with Delicious and Anisim. It is suggested therefore that Antonovka is homozygous for many of the advantageous growth factors while Black Annette approaches the opposite condition. Delicious probably is heterozygous for most of the factors concerned.

278. Dame, F. 634.11:575.183
Über die bisherigen Untersuchungen und Ergebnisse der Metaxenien-Bildung an Äpfeln. (**On the investigations and results that have been made regarding metaxenia in apples**).
Dtsch. GärtZtg. 1936 : **51**(1) : 1–3.

A concise review of the work done on metaxenia. As a possible explanation of the phenomenon it is suggested that a hormone reaction between the pollen or the pollen tube and the maternal tissues may perhaps produce changes in the expression of the genotype.

279. Dermen, H. 634.11:576.356.5:581.162.3
Fertilization in the Baldwin apple, a triploid variety.
J. Arnold Arbor. 1936 : **17** : 106–08.

Root tips were examined from seedlings obtained from 136 seeds of the variety Baldwin. Of these, 130 shewed numbers varying from 35 to 51, while others had 53, 57, 58, 59, 62 and 65 somatic chromosomes. The chromosome numbers indicate that the vast majority of seeds were formed from fertilization with normal gametes from diploid varieties and the random distributon of chromosome numbers invalidates Moffet's contention (Cf. " Plant Breeding Abstracts," Vol. II., Abst 18.) that 17 + 7 gametes are more viable than other combinations.

280. Dermen, H. 634.11:576.356.5:581.163
Aposporic parthenogenesis in a triploid apple, *Malus hupehensis*.
J. Arnold Arbor. 1936 : **17** : 90–105.

A study was made of *M. hupehensis*, which sets abundant fruit with somewhat shrivelled seeds, comparing it with *M. arnoldiana* (Rehd) Sarg. (*M. baccata* x *floribunda*), which sets fruit with normal seeds. The former species was found to be a triploid with 51 chromosomes. The meiotic and succeeding behaviour in both apples is described ; in *M. hupehensis* it results in degeneration in both pollen and embryo sacs. In the latter case the meiotic cells after degeneration are replaced by neighbouring somatic cells from which the embryo sac is ultimately formed. These embryo sacs give rise to egg cells which without fertilization develop into the embryos. In most ovules two or more of these aposporic embryo sacs fuse, thus giving rise to a number of embryos. The embryos in most seeds were diminutive in size. Large numbers of seeds were planted from which, however, only 39 seedlings were obtained. Of these, two were tetraploid, and one had roots some of which contained the triploid and others the hexaploid number of chromosomes ; the remainder of the seedlings were triploid. The tetraploids are supposed to have arisen by pollination from a diploid species and this is thought to be a means by which tetraploid species have arisen in nature.

No sign of these phenomena was found on examining another triploid apple, the variety Baldwin, and the parthenogenetic tendency in *M. hupehensis* is thought to be not so much the direct result of triploidy as the expression of a reduced sexuality and accentuated vegetative vigour which is common among distant hybrids.

The extreme constancy of the species, though obviously a hybrid, is due to this apomictic reproduction and it is suggested that other similarly constant species of the *Pomoideae* may be examples of the same phenomenon.

281. Heinicke, A. J. 634.11:581.47:575.255
To what extent is the McIntosh apple influenced by the food materials synthesized by Northern Spy leaves ?
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 336–37.

By suitable defoliation of a McIntosh tree which had been topworked with Northern Spy it was possible to obtain a crop of apples from the McIntosh branches but nourished by Northern Spy leaves. Such apples differed from normal McIntosh apples in firmness and to a certain extent in appearance and flavour.

The experiment suggests that the nature of the food materials supplied by the leaves, and determined partly by their genetic factors, functions as a factor in determining the characteristics of the fruit, in reaction with the genetic factors of the fruiting variety.

282. Crowell, I. H. 634.11–2.452–1.521.6:578.081
Index to the relative susceptibility of orchard apples to cedar-apple rust.
Phytopathology 1936 : **26** : 459–61.

The criterion, number of aecidia per lesion, is suggested as a measure of the susceptibility of a variety to *Gymnosporangium Juniperi-virginianae* Schw. being less subject to seasonal variation than number of lesions per leaf.

283. 634.13:581.163
Extract from Experimental Station, Sotschi, Russia, October 7, 1935.
Northw. Fruit Gr. 1936 : **8** (4) : 8, 9.

An account is given of the Russian discovery of vegetatively produced pears (Cf. " Plant Breeding Abstracts," Vol. V, pp. 376–77), which though produced by the fusion of leaves and of the same taste as normally produced fruit, contain no seeds or seed cells. Trees bearing fruits of this kind in addition to normal fruits have been discovered on two separate occasions and are being studied at the Sotschi Agricultural Experiment Station. They are to be crossed with other European pears in 1936.

284. 634.22:575.129:576.16
RYBIN, V. A. 634.22:575.127.2:576.356.5
Spontane und experimentell erzeugte Bastarde zwischen Schwarzdorn und Kirschpflaume und das Abstammungsproblem der Kulturpflaume. (**Naturally and experimentally produced hybrids between the blackthorn and myrabolan plum and the problem of the heredity of the domestic plum**).
Planta 1936 : **25** : 22–58.
A report of the work already reviewed in " Plant Breeding Abstracts," Vol. VI, Abst. 1363.

285. 634.23:575.12:578.08
COE, F. M. 634.23:575.11
Efforts to improve sweet cherries. Present commercial varieties have many serious defects which new breeding program aims to overcome—300 crosses made in 1935.
Fm. Res. Quart. Bull. N.Y. Agric. Exp. Sta. 1936 : **2** (3) : 1, 8.
In connexion with a breeding programme for improving sweet cherries, studies have been made of the technique of crossing and it has been found that protection of branches with muslin bags, followed by hand pollination is the most efficient method. Emasculation is unnecessary, owing to self-sterility. Using this method some 9,000 seeds were obtained from 300 crosses made by two workers in 1935.
Observations on hybrid seedlings which have fruited indicate that black flesh is dominant to white while sweetness seems to be recessive to sub-acid flavour. The best seedlings so far have been obtained from crosses involving Lambert, Schmidt, Giant and Napoleon.

286. 634.25 Georgia Hale
ARMSTRONG, W. D. 634.25:581.162.5
A fertile type of Hale peach found in central Georgia.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 290–92.
Examples of Hale peach trees bearing perfect flowers, producing abundant pollen and fully self-fertile were discovered in an orchard in Georgia and are referred to as Georgia Hale. Their fruits are yellow, freestone and of high quality, rather darker and less firm than Hale fruits. The new type is likely to be valuable commercially as it solves the pollination problem, ordinary Hale flowers producing little or no free pollen.

287. SHING, K. C. and FENG, Y. F. 634.25:581.163
(**A study of the parthenocarpy of the Shen-chou peach**).
J. Agric. Ass. China 1936 : No. 149 : 1–13.
The Shen-chou peach bears fruits of different sizes on the same branch but none below 45 grm. in weight.
A study of fruit formation and development shewed the following percentages of parthenocarpic fruits; after emasculation and bagging 34 per cent ; after bagging only, 22.3 per cent ; after natural pollination, 34–42 per cent ; after pollination by June Red (Lu-yueh-hung), out of 35 flowers only one normal fruit and 30 parthenocarpic fruits formed. As compared with the normal, the parthenocarpic fruits took longer to ripen but the percentage drop was probably less.

288. BLAKE, M.A. 634.25–2–1.521.6
Types of varietal hardiness in the peach.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 240–44.
A list is given of the different adverse environmental conditions and injuries to which different varieties and species of peach may be resistant or susceptible.

289. 634.25–2.111–1.521.6:575.12
634.25 Golden Jubilee
Golden Jubilee makes new friends in the Northwest.
N.J. St. Hort. Soc. News 1936 : **17** : p. 814, col. 3.
Golden Jubilee, a hybrid developed from Elberta and Greensboro and several other new hardy peaches developed by the New Jersey station are being tried in the North West.

290. TORRES, J. P. 634.3:581.163:575.12

Polyembryony in Citrus and study of hybrid seedlings.

Philipp. J. Agric. 1936 : **7** : 37–58.

The number of embryos per seed was counted in 126 samples of Citrus forms, representing *Citrus maxima* Osbeck (pomeloes and grapefruits), *C. sinensis* Osbeck (sweet oranges), *C. nobilis* Lour. (mandarins), *C. mitis*, *C. limonis*, *C. aurantium*, *C. aurantifolia*, *C. Webberii*, *C. hystrix*, *C. longispina*, *C. macrophylla*, a tangelo (tangerine x grapefruit hybrid) and four unidentified varieties. Of these the monoembryonic forms were : all the pomeloes, a seedling sour orange (*C. aurantium*), the carabao lime and the native lime (*C. aurantifolia*) and a wild form of *C. hystrix*. Those having 80 per cent or more of mono-embryonic seeds were : the Panuban and Triumph grapefruits, the King and Kishiu mandarins, the sour organges P.I. 1638, 7142 and Florida, the Kussai lime and the unidentified form Natsu Daidai. All these forms may be used to advantage as female parents in hybridization. All the other forms were more polyembryonic.

Since all the grapefruits are polyembryonic to some extent while the pomeloes are all mono-embryonic, it is suggested that the former might be given specific rank with the name *C. ovucarpa*.

In general, the more embryos there were per seed, the less the proportion which survived as seedlings.

Criteria for distinguishing hybrid from apogamous seedlings are given for 52 crosses. Of these, fourteen shewed heterosis, while in three crosses and their reciprocals the hybrid seedlings were less vigorous than the apogamous ones.

The percentage of hybrid seedlings obtained from a given cross depends both on the seed parent and on the pollen parent used. The King and Kishiu mandarins and the pomeloes produced 100 per cent hybrid seedlings in crosses while the polyembryonic forms produced varying percentages.

291. 634.3.00.15

UPHOF, J. C. TH. 634.31:575.257

Wissenschaftliche Beobachtungen und Versuche an Agrumen. VIII. Morphologische Studien an einem Pfropfbastard zwischen der Apfelsine Pineapple (*Citrus sinensis* Osbeck) und der Bigarade (*C. aurantium* L.). [**Scientific obseruations and experiments on Citrus fruits. VIII. Morphological studies on a graft hybrid between the Pineapple orange** (*C. sinensis* **Osbeck) and the sour orange** (*C. aurantium* **L.)**].

Gartenbauwiss. 1935 : **9** : 421–26.

The morphological features of a graft hybrid observed in a Florida orange grove are described in detail in this preliminary note. Both sour and sweet oranges were produced in quite close conjunction to each other, on the small as well as the large branches.

The phenomenon may, it is thought, be due to the effects of severe frost on the tree which, having been killed down to the site where the graft was made, then threw out new shoots in this region, causing a peculiar vertical fusion of the tissues of the stock and scion. This type of fused tissue then spread gradually throughout the whole tree with the result that the two kinds of fruits appear on all branches.

A bibliography including early and recent references is added.

292. ZARETSKY, A. J. 634.324:575.127.5

(Kumquats and their hybrids).

Soviet Subtropics 1936 : No. 7 (23) : 42–50.

Descriptions are given of the six existing species of the genus *Fortunella*, all of which are of interest in breeding frost-resistant *Citrus* varieties for the Soviet subtropics. In 1932 a successful cross was made between the kumquat and *Poncirus trifoliata* but out of 200 seeds obtained only two were hybrids. The same result was obtained again in 1933. Three vigorous hybrids are now growing and great interest is attached to them for use as rootstocks.

Much greater success was experienced in crossing the kumquat hybrids, such as the limequat etc., with *Citrus* species than on crossing the pure parents *Poncirus* and *Fortunella* ; in most cases almost 100 per cent hybrids were obtained and the *Fortunella* x *Poncirus* hybrid will probably be of interest also in this direction, for the production of triple hybrids.

Hybrids have also been obtained of kumquats with the orange. A description is given of the various hybrids of this type produced in the U.S.A., pointing out their value for Soviet breeding.

293. LEBRUN, M. J. 634.37(67.5)
Note complémentaire sur les *Ficus* du Congo. (**An additional note on the *Ficus* of the Congo**).
Bull. Inst. Colon. Belge 1935 : **6** : No. 2 : 494–97.
As a result of an examination of other collections of *Ficus* some further species are described.

NUTS 634.5

294. YABLOKOV, A. S. 634.51:575.127.2
(**Inter-species hybridization of walnuts**)
Soviet Subtropics 1936 : No. 5 (21) : 53–60.
By the interspecific hybridization of walnuts it should be possible to combine desirable characters from various species and to extend cultivation further northwards in the U.S.S.R.
Work was begun in 1933 with *Juglans mandshuricum*, *J. cinerea* and *J. sieboldiana* as female parents, and *J. regia*, *J. nigra*, *J. cordiformis*, *J. rupestris* as male parents and a number of hybrids of various kinds.
Having described the biology of flowering in the walnut, the technique of pollination, the collection and storage of pollen, the harvest, storage and sowing of the nuts, the crossability of various species is discussed.
Of the three species *J. mandshuricum*, *J. cinerea* and *J. sieboldiana*, when tested as female parents, the first crossed most easily with other species and hybrids were obtained with nearly all other species tested, but all these crosses were not equally fertile. The best results were obtained with *J. regia*, *J. sieboldiana* and *J. cordiformis* as pollinators. In 1933 the average set of hybrid nuts on *J. mandshuricum* from various combinations was 41 per cent of the total number of flowers pollinated artificially and certain combinations gave even 64–67 per cent.
Much less successful were the crosses of the American species ; for example no set was obtained with *J. rupestris*, a much lower set with *J. nigra* and only 5 per cent of hybrids with *J. cinerea*. On the other hand, when *J. cinerea* was used as the female parent in this combination, a set of 5 per cent was obtained in 1934, but 13 per cent in 1935, and seedlings raised from this hybrid seed in 1935 were very vigorous.
In general *J. cinerea* used as the female parent gave a very bad set for all three years, the average being not more than 2·5 per cent of the number of flowers pollinated. *J. sieboldiana* x *J. mandshuricum* and *J. cinerea* yielded an average of 28 per cent hybrid nuts, but their germination proved bad. Wide differences were also noted in the effects of the individual trees used in the crosses.
Since *J. mandshuricum* crosses so readily with the other species it should be the most useful for the production of hybrids characterized by good frost resistance and short vegetation period.
The two-year-old hybrids from the *J. mandshuricum* x *sieboldiana* cross comprise two equal groups. One has a short vegetation period (138 days) not very different from that of natural seedlings from the same *mandshuricum* tree but two to three times more vigorous in growth than they. The second group has a vegetation period of 148 days but is five to eight times more vigorous as compared with seedlings of natural origin. Hybrids obtained from seed from the same fruit cluster exhibit identical vigour of growth and a vegetation period of very similar length. Moreover, hybrids from seed from two different fruit clusters often differed in the above respects and might even belong to the two contrasting groups above mentioned—probably owing to the hereditary consitution of the maternal species being predominant in the one case and that of the paternal species in the other.
Both groups of the *J. mandshuricum* and *J. sieboldiana* hybrids proved winter-hardy.
With one exception, the hybrids of the *J. mandshuricum* x *J. regia* cross had a 142 day vegetation period and greater vigour as compared with the *J. mandshuricum* seedlings from the same mother tree and also shewed little difference in this respect among themselves. They also shewed good frost resistance. During the first two years of development the maternal characteristics have predominated and vigour is not equal to that of the *J. mandshuricum* x *J. sieboldiana* cross.
Two hybrids (Nos. 32 and 37) in the collection of two-year-old trees are outstanding in specially marked rapidity of growth—the maternal parent in both cases being various species while the

paternal parent of No. 32 was *J. mandshuricum*, and of No. 37 *J. cinerea*. They differed in the form of their shoots and No. 32 had a vegetation period of 155 days as compared with 167 days for No. 37. The latter, however, though it was later in forming the apical bud subsequently exhibited very rapid lignification of the woody shoot. These two hybrids promise to develop into good sized trees within a few years.

295. Bobrov, E. G. 634.54:576.16
(History and systematics of the genus *Corylus*).
Sovetskaja Botanika (Soviet Botany) 1936 : No. 1 : 11–39.
The relationships between the existing species of *Corylus* and the earlier fossil species are discussed, together with the interrelationships of the existing species and the origin of the cultivated types. These are thought to be derived by domestication in the eastern zones of the Mediterranean region, primarily from *C. pontica* and *C. maxima*, and later also from *C. avellana*. These species are recommended therefore as a source of breeding material, whilst valuable material can also be found in *C. heterophylla* and *C. americana*, especially in connexion with the northward extension of cultivation. The bush species *C. manshurica* and *C. californica* are also deserving of attention.

296. 634.58:575.42(66.3)
L'amélioration de l'arachide Sénégalaise. (**The improvement of the groundnut in Senegal**).
Agric. Elev. Congo Belge 1936 : **10** : 90–91.
In 1936 seed material of the new improved strains of groundnut was available to the extent of 350 tons and as a result of an extensive campaign in favour of these new selections it is confidently anticipated that in a few years' time none of the old types will be left but will have been all replaced by the improved strains. The success has been so great that the establishment of a number of other stations on the same lines as that at M'Bambey is planned, to cover regions of different climatic conditions.

297. Shibuya, T. 634.58:581.142
Morphological and physiological studies on the fructification of peanut (*Arachis hypogaea* L.).
Mem. Fac. Sci. Agric. Taihoku 1935 : **17** (1) : (Phytotechny No. 2) : Pp. 120.
This monograph on the physiological and morphological aspects of fructification in *A. hypogaea* with special reference to hypogeal development is based on field and greenhouse investigations made with the object of discovering some fundamental principles bearing on the practical cultivation of the plant. The problems investigated included : the relation between soil conditions (including water supply and nutrients), depth of immersion of the gynophore in water and light of various wave-lengths upon subterranean fructification ; the biological behaviour of the gynophore above ground ; the fructification process ; and flower and fruit bearing habits.
It is hoped that the investigation may be continued.
References to literature are appended.

PALMACEOUS AND OTHER FRUITS 634.6

298. Aguirre, E. F. 634.61:575.42
Aspectos en el cultivo del cocotero. Selección de semillas y trasplante de las posturas. (**Aspects of coconut cultivation. Selection of seeds and transplantation of the seedlings**).
Rev. Agric. Habana 1935 : **18** : 64–67.
Attention is called to the importance of sowing only selected seeds, namely those of 12 cm. or more internal diameter, with high yield of flesh, round fruits preferably of reddish rather than green colour, from palms with an open, somewhat spreading growth.
The treatment of the seed for sowing is indicated.

299. Nixon, R. W. 634.62:575.183
Metaxenia and interspecific pollinations in *Phoenix*.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 21–26.

Pollen of four out of five species of *Phoenix* used on *P. dactylifera* was found to give in each case differences in time of ripening or size and shape of fruit and seed, as compared with pollen of *P. dactylifera*, the one exception being *P. sylvestris*. The use of *P. reclinata* pollen, which gave consistently late ripening on the Deglet Noor variety may find commercial application in districts where early ripening is a disadvantage.

The pollen of the hybrids Deglet Noor x Mosque and Deglet Noor x Fard No. 4 shewed differences in their metaxenial effects in the same directions as the differences between Mosque pollen and Fard No. 4 pollen, indicating that metaxenial characteristics may be inherited.

300. Crawford, C. L. 634.62:575.183:581.143
Growth rate of Deglet Noor dates in metaxenia.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 51–54.

Observations on the rate of growth of fruits of the Deglet Noor variety produced by three different pollens, Mosque, Fard No. 4 and *Phoenix reclinata* indicated that the metaxenial influence of pollens became effective during the rapid period of growth. Fruits produced by *P. reclinata* reached their maximum size somewhat later than those produced by the *P. dactylifera* pollens.

Seeds shewed similar trends except that the maximum size was reached earlier.

301. Pantanelli, E. 634.63(45)
L'importanza dello studio delle varietà di olivo. (**The importance of the study of the varieties of olive**).
Atti Conveg. Olivicolo Meridionale, Bari 1934 : 15–16 September : Pp. 10.

A detailed investigation, by districts, of the varieties of olive grown in Italy has shewn that more than 150 exist. The best basis for a classification is discussed and the recognition of biotypes and ecotypes is regarded as an essential beginning. A reduction of the number of varieties cultivated and a selection of the best oil producing types is advised.

302. Priego, J. M. 634.63(46)
Las variedades del olivo generalizadas en España. (**The varieties of olives most common in Spain**).
Inst. Investig. Agron., Direcc. Gen. Agric. Madrid 1935 : Pp. 51.

Descriptions are given of thirteen botanical varieties and local subvarieties of olive grown in Spain, both botanical characters and agronomic and commercial characters being mentioned. The varieties are illustrated and a number of existing synonyms indicated.

SMALL BUSH FRUITS 634.7

303. Slate, G. L. 634.7:575(73)
New varieties of small fruits.
Horticulture 1936 : **14** : p. 129.

Brief mention is made of some of the more valuable new varieties of strawberries, raspberries and currants, and also of certain newly invented synonyms.

304. 634.71:575.127.2:576.356.4
Yarnell, S. H. 634.71:575.129
Chromosome behavior in blackberry-raspberry hybrids.
J. Agric. Res. 1936 : **52** : 385–96.

The Nessbury is an amphidiploid resulting from the cross dewberry x red raspberry and has 14 bivalents at meiosis. In the F_2 of the back-cross to the dewberry diploids, triploids and tetraploids were observed. In the F_2 and F_3 of back-crosses to red raspberries only tetraploids were found, possibly owing to selection of plants resembling the Nessberry in earlier generations. Similarly in the F_3 of an outcross to the Early Harvest blackberry only tetraploids were found.

The polyploid forms were mostly unbalanced, being characterized by multivalent formation and irregular disjunction at meiosis. Wide variations in vigour and fertility were observed, the latter correlated to some extent with cytological regularity.

The complications introduced into breeding by a doubling of chromosome number are discussed.

305. 634.711 Taylor

SLATE, G. L. 634.711:575.12(74.7)

Name new red raspberry after O. M. Taylor said to be best late variety growing on station grounds, with promise of wide popularity both for home use and for commercial planting –a Lloyd George seedling.

Fm. Res. Quart. Bull. N.Y. Agric. Exp. Sta. 1936 : **2** (2) : 1, 11–12.

Produced by a cross between the varieties Newman and Lloyd George, the new variety, Taylor, is noteworthy for its large fruits with bright colour, attractive appearance and excellent quality ; they are firm and have no tendency to crumble. The plants are tall and vigorous, produce heavy crops and multiply rapidly. The canes are sturdy and support will not be necessary. The prickles are short and stubby and should not interfere with picking.

Other seedlings of considerable promise were derived from the same cross.

306. COLBY, A. S. 634.711–1.533:575.11

The inheritance of suckering and tip layering in purple raspberry seedlings.

Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 427–27.

While most red raspberries propagate by suckers, black raspberries propagate by tip layers. The progenies of different crosses between the two types contained different proportions of seedlings propagating by suckers.

307. ODLAND, T. E. and STENE, A. E. 634.715:575.11:581.49(74.5)

Inheritance in blackberries.

Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 423–26.

A list is given of the varieties used in crosses and of the crosses made in connexion with breeding work at the Rhode Island Agricultural Experiment Station. The varieties are classified according to their habit of growth and their thorniness, the characters to which special attention is being paid. Seediness and fruit quality will be considered as soon as time and facilities permit. Thornlessness and trailing habit appear to be dominant characters.

308. 634.75 Wädenswil

GOETZ, O. 634.75:575.12(49.4)

Die Erdbeer-Neuzüchtungen " Wädenswil I " und " Wädenswil II." (**Newly bred varieties of strawberries " Wädenswil I " and " Wädenswil II**).

Obst- u. Gemüsb. 1935 : **81** : p. 138.

Crossings of different varieties of strawberries were begun in 1927 at Wädenswil in Switzerland with the object of evolving new varieties which should be as resistant as possible to *Transonemus Fragariae*, early maturing and of high quality as regards the fruit. Out of over 2,000 seedlings examined and judged in 1928 29 only the varieties Wädenswil I and II came through the severe process of selection extending over some years.

The two successful varieties are described. Wädenswil I was derived from a Deutsch–Evern x Osterfee cross and Wädenswil II from a Späte von Leopoldshall x Hansa cross.

309. 634.753 Baron Solemacher

GOETZ, O. 634.753:575.12

Die rankenlose, immertragende Monatserdbeere " Baron Solemacher." (**The perpetually fruiting Alpine strawberry " Baron Solemacher "**).

Obst-. u. Gemüseb. 1935 : **81** : 122–23.

A recent production, the result of the breeding operations extending over some years, carried out by Baron von Solemacher at Antweiler. The new strawberry is remarkable for its size, weighing up to 4 grm. The flavour, which is highly aromatic, resembles the wild strawberry. The process of ripening is very even, probably owing to the fact that flowering and ripening of the fruit takes place above the level of the leaves. The yield of fruit and the germination percentage of the seed are high and seedlings sown at a suitable time in spring set fruit in the same year.

310. KISHIMA, T. and OKAMURA, M. 634.774:575:581.6(52)
(The improved pineapple varieties in Formosa).
Rep. Dep. Agric. Govr. Res. Inst. Formosa 1936 : No. 69 : Pp. 48.

The pineapples grown in Formosa include the indigenous varieties Wohi Mushi-kohi, Kohi and the imported varieties, Smooth Cayenne, Singapore, Mauritius, and Canning. The hybrids between Smooth Cayenne and Singapore were found to be suitable for eating in the natural state as the pulp is soft and the juice very sweet ; and on crossing with native varieties (Wohi, in particular) a bright yellow, soft pulped type, suitable for canning, was obtained.
The object of the present experiments was to eliminate by crossing the susceptibility to wilt and to obtain good types from the first cross.
Selection is difficult as few good varieties are available and ten years is the period allotted for the selection process, dating from the first cross pollination and collection of seed in the first year to the ultimate selection and propagation of the best varieties in the tenth year.
The technique of crossing is described, the varieties used being Smooth Cayenne, Singapore, Wohi, Mushi-Kohi, Mauritius and Canning. Full details of the numerous crosses made are given in tabular form and the method of raising the seedlings is indicated.
After planting out, the young plants bear fruit in one year if early maturing and in two years as a general rule. The fruits are examined for shape, quality, core, (its diameter and whether hard or soft), juice, flavour, spines (or their absence), the best strains are chosen and selection is continued, the vigour of the plants and any changes in shape or quality being noted.
In 1934 six varieties derived from the following crosses were selected and named :—Tai-no No. 1 from Sm (Smooth Cayenne) x Wo (Wohi) No. 368 ; Tai-no No. 2 from Sm x Wo No. 1035 ; Tai-no No. 3 from Wo x Sm No. 23 ; Tai-no No. 4 from Sm x Si (Singapore) No. 214 ; Tai-no No. 5 from Sm x Si No. 2 ; Tai-no No. 6 from Si x Sm No. 77. The first three are suitable for canning and shew a higher yield than Smooth Cayenne, the difference being 12 per cent for Nos. 1 and 2. Tai-no No. 4 is of excellent flavour eaten in the natural state and the winter fruits are particularly delicious. The plant is spiny but extremely vigorous. No. 5 is vigorous and gives a high yield of fruit for eating in the natural state. No. 6 has a very large core which is, however, as soft as the pulp so that it need not be removed either for eating or canning purposes. The plant is vigorous and a high yielder.

VITICULTURE 634.8

311. ROUSSOPOULOS. 634.835:575
Règles à suivre pour la sélection des variétés de raisin pour la table et pour la vinification. (**Rules to be followed in the selection of varieties of grapes for the table and for wine-making**).
IV^e^ Congr. Int. Vigne et du Vin, Lausanne 1935 : **2** : 18–27.

The qualities in respect of many different characters which are to be desired in grapes for the table are enumerated. The importance of selecting for quality is emphasized and the production of varieties suitable for two or more purposes is recommended.
In connexion with grapes for wine-making, although the requirements differ in some respects, it is suggested that their problems should be considered together with those of table grapes.

312. VOBORIL, F. 634.835:575(43.6)
Prinzipielle Erfahrungen aus 15 Jahren Klosterneuburger Rebenzüchtung. (**A theoretical discussion of the results from 15 years of vine breeding at Klosterneuburg**).
Weinland 1935 : **7** : 454-58.

When vine breeding in Austria began 15 years ago Zweigelt had four aims in view, (1) to obtain a valuable stock vine ; (2) the breeding of disease and phylloxera resistant hybrids ; (3) the breeding of early and late ripening dessert crops ; (4) breeding of early ripening, high yielding crops of good quality for wine making.
Crossing experiments have shewn that our superior varieties are not genetically pure forms. Long cultivation has brought in high quality and on the other hand susceptibility to disease. The author gives results of crosses and comes to the following conclusions : varieties with more

or less hereditarily constant morphological features give their characteristics to the seedling, regardless of the fact of whether they are used as male or female parent: earliness and yield capacity are regarded as not being hereditarily constant. In conclusion the further lines on which breeding may progress are outlined as follows: (1) the testing of varieties for their hereditary constancy and other characteristics is to be carried out with seedlings from selfings and by mutual pollination within a clone; (2) Gutedel is not to be used as a basis of new varieties, for which hereditarily constant varieties should be used; (3) in F_2 different individuals of a cross belonging to a strain are to be crossed *inter se*. A.B.

313. VOBORIL, F. 634.835:575(43.6)
Von der Auslesezüchtung. (**On breeding by selection**).
Weinland 1935 : **7** : 298–301.

There is a marked lack of really good quality wines. Attention to breeding can change this state of affairs. Frequently what is regarded as a variety contains a medley of several forms which it is essential to distinguish. Breeding by selection must not however, limit itself to the separation of forms. Valuable types obtained by breeding may be lost by bad handling. Old vineyards, and also very young ones, are less suited for selection. In the first place inferior material must be rejected — negative selection; but positive selection must also play its part with a view to the future. Instead of the original mass selection, individual plant selection must be substituted (practised for the last 15 years in Klosterneuburg). Stocks, the bunches of which weigh very heavy should not be chosen since they fall off the branches. The best stocks are multiplied separately and clone vineyards laid down. In Klosterneuburg the central vineyard of clones contains the material obtained from the best clones in the whole of Austria. A.B.

314. ZWEIGELT, F. 634.835:575(43.6)
Fünfzehn Jahre Rebenzüchtung in Österreich. (**Fifteen years of vine breeding in Austria**).
Weinland 1935 : **7** : 385–87, 425–27.

The early history of vine breeding in Austria is outlined with due notice of the achievements of Linsbauer and Zweigelt. The work of the Austrian Viticultural Committee, set up at the suggestion of the author, and *inter alia* engaged in issuing the register of pedigree vines, is mentioned. The impetus subsequently given to breeding work, including investigations on selection, instructional measures, pedigree records and the establishment of breeding plots at Klosterneuburg, etc., is described. As early as 1932 whole series of valuable numbers were entered in the pedigree register. Testing of foreign vines obtained by breeding was inaugurated. In 1922 an extensive breeding programme was worked out with the object of improving the indigenous varieties by crossing and also of obtaining new direct producers and vines for use as stocks. The paper closes with a short description of the individual breeding plots and additional details on studies relating to types, the biology of flowering, breeding for immunity, etc. A.B.

315. 634.835:575(43.72)
STUMMER, A. and FRIMMEL, F. 634.835–2–1.521.6
Bericht über die Rebenzüchtungsarbeiten des Jahres 1935. (**Report on the work of vine breeding in the year 1935**).
Verlautb. dtsch. Sekt. mähr. Landeskulturrat. 1935 : **36/12** : No. 12 : 201–03.

The spring frosts of 1935 caused extensive damage to vine breeding. This year for the first time the sugar content of the grapes of numerous seedlings was determined with the Zeiss refractometer and useless seedlings were eliminated. The clones Veltliner rot 181, Rheinriesling rot 197 and Portugieser grau 17 were tested on a large scale. Sylvaner grün, Stock No. 281, which had a high yield, average sugar content and a remarkably low acid content, was selected. Gutedel is of considerable importance for certain districts. In the case of Veltliner selection was stopped and begun again with new material. Gutedel rot was more reliable. In the case of Veltliner grün too, no main clone was selected. Experiments with the Wildbacher variety from Steiermark, which is immune to *Peronospora*, gave interesting results. Of the 1,660 seedlings obtained from

first buds that had been allowed to wither without interference, 12 per cent were variegated. Artificial infection with water containing *Peronospora* spores produced a devastating effect. One single plant remained healthy ; with some of the other less diseased plants it was used for further breeding. Details relating to the 1935 seedlings, including the number of berries and seeds, germination, etc., are given in tabular form. A.B.

316. Garcia de los Salmones, N. 634.835:575(46)
Les diverses variétés de raisins et la génétique viticole. (**The different varieties of grapes and the genetics of vines**).
IV^e^ Congr. Int. Vigne et du Vin, Lausanne 1935 : **2** : 3–17.

A list of the wine and table grape varieties of the different districts of Spain is given and the importance of the variety with respect to the quality of the product is discussed. It is emphasized particularly as regards wine varieties, that the varieties associated by tradition with a given locality are well adapted to that district and the introduction of new varieties is likely to lead to a reduction in the quality of the wine. Breeding work should therefore be concerned with the improvement of existing varieties by selection rather than with the production of new varieties by hybridization, to which the author considers far too much attention has been paid.
The author is concerned with the publication of a monograph of Spanish vines, containing a descriptive list of over 2,000 named varieties, and suggests that a similar work should be produced by every country with the ultimate aim of producing a list of all the varieties of grapes in the world.

317. 634.835:575(75.8)
Armstrong, W. D. 634.835:581.162.3
New varieties and pollination of Muscadine grapes.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 450–52.

A very brief account of the breeding work with Muscadine grapes (*Vitis rotundifolia*) at Experiment, Georgia is given. So far eleven varieties have been named and introduced, Hunt, Dulcet, Qualitas, Irene and Spalding, dark grapes, and Howard, Stuckey, Lucida, Browney, November and Yuga, light or amber-coloured. Other seedlings are shewing promise and breeding and testing are being continued.
The importance of an adequate supply of male vines for pollination is stressed.

318. Negrul, A. M. 634.835:575.125:575.14
Inzucht und Heterosis bei der Rebe. (**Inbreeding and heterosis in grapes**).
Züchter 1936 : **8** : 137–45.

The poor germinating capacity held by some workers to be a characteristic of inbreeding in grapes is shewn to be a varietal character as is also weak growth and late fruit bearing in the seedlings. Crosses between varieties of *V. vinifera* shewed no heterosis. This occurred only in interspecific crosses and then only in respect of growth and not in fruit formation.
The selfed F_1 of interspecific hybrids segregated in F_2 to an extent which varied with the combinations made. In several crosses dwarf bushy forms appeared as recessive characters and a study of the various forms may help to elucidate the origin and genetical constitution of *V. vinifera*.

319. Snyder, E. and Harmon, F. N. 634.835:575.252
Three mutations of *Vitis vinifera*.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 435–36.

The mutants are a large fruited Sultanina, a small-fruited Sultanina and a seeded Panariti (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 1401). The first may have some value in breeding work and for local use, but the other two have not.

320. Stummer, A. and Frimmel, F. 634.835:575.42(43.7)
Über einige Ergebnisse der Selektion bei Sylvaner und Gutedel. (**On some results of selection in Sylvaner and Gutedel vines**).
Winzer 1936 : No. 4 : Pp. 8.

Twelve years of selection work with Sylvaner grün, Gutedel rot and Gutedel weiss on the basis of records of weight of yield, are briefly summarized. Of the Sylvaner grün clones No. 281 is regarded as the best, its average yield being 1·95kg. with 19·9 per cent sugar content and 9·5 per cent acid content.

Reliability in flowering was taken as one of the main aims in making the Gutedel selections. Sucker production was used as a criterion in detecting desirable and undesirable types. Clone No. 262 with an average weight of 2·02 kg., 17 per cent sugar content and 6 per cent acid content would seem to be the best of the Gutedel rot group. Gutedel rot clone No. 212 though apparently superior to No. 262 is suspect owing to its origin from the lowest yielding stock and must be closely observed for a further period.

Selection of Gutedel weiss material has been unsuccessful and must be begun again on a new basis.

321. Olmo, H. P. 634.835:576.356.5:575.252
Bud mutation in the *Vinifera* grape. II. Sultanina gigas.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 437–39.

Somatic mutation to a gigas form has occurred on several occasions in the Sultanina grape. The gigas form, which is autotetraploid and has 76 chromosomes, has certain cultural disadvantages such as brittle cluster stems and pedicels and an inability to bear well-filled clusters consistently. It may, however, be of value in breeding varieties with high chromosome numbers as it appears to cross readily with diploid varieties.

322. 634.835:581.163:575(74.7)
634.835 Bronx Seedless
Stout, A. B. 634.835 Stout Seedless
Seedlessness in grapes.
Tech. Bull. N.Y. St. Agric. Exp. Sta. 1936 : No. 238 : Pp. 68.

A full account of seedlessness and related phenomena in grapes is given. There are two main types of seedless grapes ; those like the Corinth grapes, truly parthenocarpic and those like the Sultanina grape in which fertilization does occur but only pulpy aborted seeds are found in the ripe fruits, a condition termed stenospermocarpy, the seeds being described as stenospermic. The second type offers the greater promise in breeding seedless grapes owing to the larger fruits. Different grades of ovule development occur and parthenocarpy may be vegetative or stimulative, obligate or facultative. Mixtures of different types of fruit may occur in single bunches, depending on the condition of the ovaries and on the effectiveness of pollination.

In a project carried on by the author in co-operation with the New York State Agricultural Experiment Station to develop, by breeding, hardy seedless grapes of value for culture in a climate such as that of central New York, over 80 stenospermocarpic seedlings have now been obtained from the F_1 and succeeding generations of crosses between tender, *Vitis vinifera* seedless varieties, such as Sultanina, Sultanina Rose and Black Monukka, and hardy seeded varieties. The best of these, derived from a cross between Seedling No. 8,536 (Goff x Iona) and Sultanina has been named Bronx Seedless. The first obtained, Seedling No. 10,918 was named Stout Seedless. So far no seedling has been obtained which bears fruits in quantity all of the Corinth type ; efforts, however, are being made to produce such parthenocarpic types as well as the stenospermocarpic ones.

323. Stout, A. B. 634.835:581.163:575(74.7)
Breeding hardy seedless grapes for New York. Sixteen-year effort rewarded with development of promising new variety, studies also throw much light in types of seedlessness in grapes.
Fm. Res. Quart. Bull. N.Y. Agric. Exp. Sta. 1936 : **2** (3) : p. 13.

A brief account of seedlessness in grapes and of the breeding work on seedless grapes at the New York Botanical Gardens and the New York State Agricultural Experiment Station (Cf. Abst. 322 above).

324. Kober, F. 634.835–1.541.11:575(43.6)
50 Jahre " Unterlagsfrage." (**Fifty years of the problem of stocks**).
Weinland 1935 : **7** : 282–84.

The author gives an account of his experiences extending over 50 years, relating to the development of this problem of stocks in Austria. The origin of the Riparia hybrids, the early work to obtain direct producers and the experiments made in introducing the newer French hybrids into Austria at the suggestion of the author, are outlined. After tests lasting 20 years the French hybrids proved unsuited for the northern regions. *Vitis Berlandieri* could not be used from a practical standpoint, but the grafts were very productive and displayed excellent superior grapes. After 20 years of rigid selection the author succeeded in isolating from *Vitis Berlandieri* seedlings obtained originally from S. Teleki, a form with red branches that was also smooth and bronze topped, which was designated " 5 BB." This form combined the characteristics of *Vitis Berlandieri* and *V. Riparia*. S. Teleki bred from the same material in Hungary another variety " 8 B " and both these forms have been most valuable in vine cultivation in Austria and other regions. A.B.

325. Dalmasso, G., Cosmo, I. and Dell'olio, G. 634.835.094
Gli ibridi P.D. a Conegliano. Risultati di undici anni di osservazioni. (**The D. P. Hybrids at Conegliano. The results of 11 years' observations**).
Ann. Sper. Agr. 1936 : **19** : Pp. 439.

The vineyards of the Royal School of Viticulture at Conegliano, destroyed during the Great War, were restocked between 1922 and 1923 with about 300 hybrids, which number was gradually increased to 455.
The present monograph represents a detailed study of these direct producers. Their characteristics are described and tabulated and the final conclusion is reached that, while many are disease-resistant and many others of good quality the ideal form, which should combine vigour, disease resistance and good quality of wine, has yet to be obtained.

326. Suškov, V. 634.836(47)
(**The best varieties of vine**).
Yalta 1936 : Pp. 19.

The Crimean viticultural station possesses a collection of about 800 vine varieties. A description is here given of a number of the varieties which as a result of experience have been chosen as the most promising, indications being given of the quality, earliness and disease resistance.

FORESTRY 634.9

327. Staf, C. and Teerink, E. 634.972.1:576.16
De wintereik (*Quercus sessiliflora* Salisb.). [**The winter oak** (*Q. sessiliflora* **Salisb.**)]
Tijdschr. Ned. Heidemaatsch. 1936 : **48** : 123–37, 168–88 and 201–12.

This paper deals with the nomenclature of the winter oak (sessile oak) and the distinctive characteristics of it and of the summer oak (pedunculate oak), and with transition forms between the two types, with their distribution, growth requirements, relative susceptibility to mildew and insect attack and yield of timber.
In discussing the transition types the question of crosses between the winter and summer forms is considered but no definite pronouncements can yet be made when it is a question of deciding whether an individual is a hybrid, a modification or a mutation. The existence of races (or modifications) has been demonstrated for the summer oak but not for the winter oak, which has not yet been investigated from this standpoint.
Illustrations and a bibliography conclude the paper.

328. 634.975:576.16
MÜNCH, E. 634.975–2–1.521.6
Das Lärchenrätsel als Rassenfrage. Zweite Mitteilung: Die Lärche im Seeklima. (**The riddle of the larch as a question of race. Contribution II. The larch in maritime climates**).
Z. Forst- u. Jagdw. 1935 : **67** : 421–42, 483–500.

Evidence in support of the writer's theory that the different behaviour of larches occupying the same locality is fundamentally a question of race has been obtained by a study of the adaptation of certain larch stands under conditions of a maritime climate in various European countries. Certain strains appear extremely well adapted to their surroundings. Additional evidence is found in the records of the resistance to "larch disease" (or "larch die back"), exhibited by the various strains or the stands derived from seed of various origin.

VEGETABLES 635

329. *KOČNAR, K. 635:575(43.7)
Vyhlídy zušlecht' ování zeleniny v Československu se zvláštním zřetelem k výzkumnictví a pokusnictví. (**Prospects of improving vegetables by breeding in Czechoslovakia with special reference to research and experimental work**).
Časové Otáz. Zeměd. 1934 : **41** : 11–14.

Vegetable breeding on scientific lines is not very extensively practised in Czechoslovakia and might be extended with advantage to the districts at present engaged in growing various kinds of vegetables in which they specialize. The breeder should aim at improvement under similar conditions to those in which the grower raises his crop and the improved types must be judged on a similar practical basis. At the present time pedigree seed is rarely in demand and when it is, seed of foreign origin is preferred.
The breeder can of course decide to breed crops suited to any region, which is a less practical procedure than specializing in the requirements of definite localities.
The difficulties and other biological phenomena encountered in breeding work are mentioned e.g. cross-pollination, biennial habit of many species, sterility, heterosis, set of seed, etc.
The numerous economic demands of the present day as regards yield, quality, earliness, flavour, and good keeping, storing and pickling qualities necessitate a fairly large number of varieties of individual species of vegetables. In view of the small total area devoted to vegetable growing, the breeder should choose a small range of crops to begin with. Among those recommended as offering good openings are field crops such as cabbage, cucumbers, onions, garlic, carrots and potatoes and in preference to high yield, quality should be stressed, including earliness, winter hardiness and the valuable property of keeping during transport and storage, and in the case of potatoes also suitability for early germination. Market garden crops should of course also be improved.
Abundant material is available for breeding purposes in the good old indigenous varieties: a collection of this material should be made by agents of various institutes and placed at the disposal of the breeder. This has already been successfully done in Moravia.
Though by this means pure indigenous varieties may be obtained only in isolated cases the acclimatized crosses of such indigenous forms with improved varieties may be valuable to the breeder. Criteria for the selection of suitable material include progeny tests of super-élite forms. In addition to individual selection hybridization especially would be practised and the possibility of valuable results from heterosis or from natural or artificial mutations (e.g. polyploids) is mentioned.
Those wishing to embark upon the improvement of vegetables by breeding are reminded that there are already stations for this purpose, either privately owned or belonging to associations or institutes; hence breeders should combine and confine themselves to whatever crops are most suited to their individual circumstances and mutual competition is to be avoided. Similar investigations could however be carried on in several places and ultimately extended at whichever places might be chosen. Public institutes alone should be engaged in breeding crops and in investigations of little or doubtful immediate economic value.

*A translation of this paper is on file at the Bureau.

330. Nissley, C. H. 635:575.42
Seasonal facts and suggestions for vegetable growers. It pays to select your own seed.
N.J. St. Hort. Soc. News 1936 : **17** : p. 815–16.
Instructions are given to growers for selecting their own seeds from vegetable crops.

331. 635:608.3(77.3)
What is a " basic plant patent" ?
J. Hered. 1936 : **27** : 213–16.
A discussion of the possibility of obtaining in the U.S.A. a basic patent for a type of plant as distinct from a patent for a given plant and its asexually reproduced progeny.

332. Beattie, J. H. and Boswell, V. R. 635–1.421
Statistical studies of apparently uniform fields of carrots and onions on peat soils.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : p. 472.
Statistical studies indicated that machine methods of planting and culture do not in themselves ensure sufficiently uniform small plots to permit distinction of small differences without an inconveniently large number of replications.

333. 635.13:581.19:575
Emsweller, S. L., Burrell, P. C. and Borthwick, H. A.
Studies on the inheritance of carotene in carrots.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 508–11.
Analyses of carotin in different parts of the root shewed that there was more per 100 grm. of dry matter in the top than in the bottom in both phloem and xylem, and that there was also a greater proportion in the phloem than in the xylem.
While the external colour of a root was not always a reliable indication of its carotin content the total extracted pigments as measured on a colorimeter before separation of the carotin and xanthophyll gave a very good measure of carotin content.
Inbreeding for four generations was found to increase uniformity considerably with respect to carotin content and was also found to segregate outlines of different carotin content.

334. Currence, T. M. 635.13–1.421
Relation of plot size and shape to variability of carrot yields on peat soils.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 484–88.
A uniformity trial was carried out with carrots and the results were analysed by Fisher's analysis of variance method. There were considered to be eight treatments, and twenty-four different plot sizes and shapes were studied, 0·5, 1·0, 1·5 and 3·0 rods long, and 1, 2, 3, 4, 6, and 12 rows wide, the rows being 16 inches apart. The variance due to blocks was eliminated and the efficiency of the different types of plot was considered. It appeared that single row plots of 3 rods length would be a suitable size, requiring six replications to detect 10 per cent differences with odds of 20 : 1.
The data suggest that some peat soils shew large variations in fertility as do mineral soils, and, in spite of the uniform appearance of the land or crops, plot technique cannot be neglected.

335. Levan, A. 635.25:576.356.5:581.162.5
Polyploidy and self-fertility in *Allium*.
Hereditas, Lund 1936 : **22** : 278–80.
Data are presented to shew that in *Allium Schoenoprasum* L. and *A. nutans* L. self-fertility increases as the chromosome number increases. This, it is considered, is one of the factors which have given an impulse to polyploidy in these species.

336. 635.25:581.143.26:575(79.4)

JONES, H. A., POOLE, C. F. and EMSWELLER, S. L.

Bolting habit in the onion.

Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : p. 490.

Conditions on the central coast of California make bolting very prevalent and the locality is therefore very suitable for developing non-bolting strains for the milder districts. Lines have been isolated that are much less prone to bolt than the parental varieties.

337. KATAYAMA, Y. 635.25:581.162.5:576.354.4:576.356.5

Chromosome studies in some *Alliums*.

J. Coll. Agric. Tokyo 1936 : **13** : 431–41.

In the strains Akakuki, Zairai and Shirokuki of *Allium Scorodoprasum* L. var. *viviparum* Regel 16 chromosomes were found in the root tips. Meiosis in Shirokuki was regular but in the other two strains, which were very similar morphologically, multivalent formation was observed. All three forms are sexually sterile, reproducing by bulbils, and this sterility is thought to be conditioned genetically in Shirokuki and by chromosome abberations in Zairai and Akakuki.

Meiosis in tetraploid forms of *A. odorum* L., *A. Bakeri* Regel, and *A. nipponicum* Franch. et Sav. shewed the irregularities characteristic of autotetraploids.

338. 635.34:551.566.3:575

(**Cultivation and varieties of cabbage in the north**).

Bull. Appl. Bot. Leningrad 1936 : Ser. VI (1) : Pp. 96.

D. I. Vvedensky. *Experiments on the biology of cabbage under northern conditions.* (*pp. 3–68, 94–95*).

The cabbage can be cultivated well within the arctic circle, even at Murmansk, but the further north its cultivation is taken the more important does the choice of variety become, earliness being the main deciding feature. Numerous practical illustrations of this are quoted, supported by tests of over a hundred cabbage varieties in the northern Ural region during the period 1931–1934, under different experimental conditions of cultivation. The observations made during this time upon yield, earliness and size of head are reported. The variety No. 1 proved the best over the four years in respect of earliness though in yield and size of head it was excelled by the variety Glory of Enkhuisen. Various other promising kinds are mentioned. The vitamin C content of the varieties varied from 250 biological units to 900, the sugar content from 3·10 per cent to 6·36. The best variety in respect of vitamin C and sugar content was Ditmarskaja and when keeping capacity and freedom from bursting, whiteness of leaves and excellence of flavour were taken into account a fourth variety proved best, namely a Russian variety Val'vat'evka. The combination of all the desirable qualities of these four varieties therefore represents a breeding problem of some complexity.

Furthermore, marked varietal differences were detected also in response to manuring, to earlier sowing, which in certain early varieties may double the yield, to different times of transplanting and methods of cultivation and to differences in length of day ; head formation is retarded by long day and it is essential that breeding for earliness be carried out in the extreme north. Short day accelerates heading in mid-season and late varieties are unaffected.

Observations were made on a number of other characters of the head and stem and their variance in the different varieties ; the results are tabulated and discussed. The characters were studied under a number of different growth conditions so that their degree of constancy in heredity might be disclosed. The form of head proved to be the most constant character, its weight the most variable ; the variance of each character was different in different varieties.

Certain correlations were established, e.g. a valuable negative correlation between the weight of stalk and earliness, which enables selections to be made for earliness with great accuracy. The seedling characters were correlated with many agronomically important characters in the mature plant and this presents a useful guide in selecting in the early stages. Many characters of the plant at the time of seeding were also so correlated.

Many of the late varieties displayed under northern conditions a tendency to develop an elongated or conical head, apparently due to the effect of the too short day length at the end of the season.

This effect can be utilized to test the homozygosity of varieties and all breeding material should be subjected to northern conditions so that forms with the tendency can be eliminated.
The variety Val'vat'evka and other Russian varieties proved most resistant to spring frosts and drought and were generally more tolerant of unfavourable growth conditions, partly owing to their vigorous root system ; Val'vat'evka was also one of the best keepers. Best of all in keeping capacity was a late variety Amager and in this connexion, combined with earliness, high yield, firmness of head and good flavour, reference is made to a new hybrid of No. 1 x Kaširka which is said to be very promising. Experiments were also made on the best varieties for fermenting.
The result of these investigations is to shew that many of the Russian varieties have combinations of very promising genes and should make suitable material for breeding northern forms.
Tests of a similar nature but on a smaller scale were made on a number of other *Brassicas* including red cabbage, cauliflower, savoys and kohl-rabi. With suitable times of sowing the long days could be utilized to obtain a rapid and abundant supply of seeds both of cabbage and kohl-rabi.

D. I. Vvedensky. *On the methodics of breeding white cabbage for earliness.* (*pp. 69–93, 96*).

Early maturity is a feature in which nearly all varieties, being cross-pollinators, are to a greater or lesser extent heterozygous. The best methods so far proposed for determining time of maturity are somewhat arbitrary, by visual observation, touch, etc. The present observations have shewn that the size of the stalk provides a remarkable index of the earliness of a variety or line, the earlier the variety the smaller and thinner does the stalk tend to be. The differences between varieties are detectable even under conditions where no head is formed and serve therefore as an admirable criterion upon which to base selection for earliness. If this alone is applied, however, a reduction in size of head also results, so that it is important that in any stalk class the individuals with the greatest size of head be selected. The weight of the stalk varies from 50 grm. to 1 kg., the length of the vegetative period from 60 to 120 days. However, within certain varieties variations were observed in the weight of the head in the class of plants all having the same weight of stalk ; it is the forms with the highest weight of head for a given low stalk weight that must be selected in breeding high yielding early varieties.
Other correlations with earliness were total weight of plant and weight of head ; also type of seedling which is a correlation that deserves further attention and study, and type of plant at the time of seeding. Variations in the stalk weight were observed between the different plants within a variety or line. A study was made of the families of three plants with average stalk weight and of two plants with large stalk. The progenies all preserved the character of the parents and those from the medium parent ripened in 78–85 days, those from the large parents only in 102 days, thus illustrating the hereditary nature of these two characters and their correlation.
Figures are given shewing the variance of the weight of stalk in different years and in different growth conditions, which proved quite low compared with the differences between families of different vegetative periods. The value of the character for selection for earliness was hereby confirmed and was further corroborated by observation on red cabbage and savoys.

339. Saltykovsky, A. I. and Federov, V. S. 635.44:575.11.061.63
[Chlorophyll abnormalities in white mustard (*Sinapis alba* L.).]
Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 287–305.

A knowledge of the inheritance of chlorophyll defects is important in order to be able to remove them from the population. Self-pollination by bagging was therefore carried out in about 1,200 plants in 1932, and 2,000 of the resulting plants were bagged to obtain an F_2. Among the seedlings various chlorophyll anomalies were observed of the types *Albina*, *Xantha*, *Virescens*, *Transgrediens* (plants which start green, later become yellow and finally end normal green though dwarf in habit) as well as variegated forms ; the *Xantha* were the most frequent. The frequency of all forms was twice as great in the second as in the first inbred generation ; the actual proportions were different in different families, some families having as many as 25 per cent *Albina* and 66.6 per cent *Virescens* seedlings.
The results of the first and second generation segregation shewed the *Virescens* type to be monofactorial and *Albina* bifactorial. The total proportion of normal : aberrant was however 3 : 1

shewing that one basal gene *W* is present for normal pigmentation, in the absence of which *V* gives *Virescens* and *v Albina*. The gene *v* has no effect in the presence of *W*. There was a marked deficiency of normal individuals in certain families and various possible explanations for this are suggested. The deficiency was observed in the progeny of the double heterozygotes and was different in degree in different families ; it is thought to be most probably due to the varying self-fertility of the different families.
The *Transgrediens* type was also monofactorial, the gene being named *t* ; in some of the families heterozygous for this character *Xantha* and *Albina* types also segregated, suggesting some con nexion between them.
Different lines of mustard gave differing degrees of deterioration on inbreeding.

340. COMIN, D. 635.53–1.421:519.24
Plot technique in field celery experiments.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 524–27.
In a fertilizer experiment with celery the plants were harvested in units of ten plants and the results were utilized in a statistical investigation into plot technique.
It was found that adjusting yields for stand by means of the regression of yield on stand gave no increase in precision, nor did trimming the plants.
The standard error of a ten-plant unit after removing the effect of soil heterogeneity was found to be 1·75 per cent and it was calculated that to obtain a standard error of 5 per cent with a plot of 1/72 acre about 100 plants were required or 148 in a plot of 1/5 acre.

341. LESAGE, P. 635.563:575.31"793"
Sur la précocité acquise et héritée à Rennes et à Alger, en 1935. (**On acquired and inherited earliness at Rennes and at Algiers in 1935**).
C.R. Acad. Sci. Paris 1935 : **201** : 791–92.
A brief note on the progress of the author's experiments with *Lepidium sativum*. Seed from plants cultivated at Algiers for some generations, when sown at Rennes, gave plants exhibiting acquired and hereditary earliness. (Cf. " Plant Breeding Abstracts," Vol. VI, Abst. 1030).

342. 635.6:581.162
FILOV, A. I. 635.61:575.11–181:581.47
(**The floral biology and fruit development in cucurbits**).
Bull. Appl. Bot. Leningrad 1935 : Ser. A (16) : 103–19.
Detailed descriptions are given of the reproductive organs of the cucurbits and of their floral biology in general. Examinations were made on the numbers of placentae in the fruits of a number of progenies of élite lines of different varieties of watermelon and these were found to vary distinctly in the proportion of fruits with over three placentae. Some lines had over 50 per cent and there seems no doubt that the character is an hereditary one and subject to improvement by selection.
The period of receptivity of the stigma in watermelons was found to be about six days. Viable pollen can be obtained the day before the opening of the flower and remains viable for 4–5 days. At least 400-1,000 pollen grains are required for successful pollination and early morning or late afternoon are the most favourable times for pollination.
The capacity for self-fertilization varies very much from variety to variety in both melons and watermelons. The rudimentary pollen is found to be as effective in pollination as normal pollen and varieties where it is present shew quite a high proportion of self-pollination.

343. WILSON, J. J. 635.615–2.484–1.521.6:575
The pathological relationship between the host and parasite in varieties and strains of watermelons resistant to *Fusarium niveum* E.F.S.
Res. Bull. Ia Agric. Exp. Sta. 1936 : No. 195 : 107–52.
Studies on the infection of watermelons (*Citrullus vulgaris*) by *Fusarium niveum* E.F.S. shewed that the characteristic wilting was caused by occlusion of xylem elements by tyloses, gum-like materials and mycelium, with consequent interference with the transpiration stream. There was

evidence, however, that the gum-like material and tyloses may have a deleterious effect on the parasite as well as on the host.
Resistant plants were more susceptible in the seedling stages and the heaviest mortality occurred within 30 days after planting, after which period there was an abrupt decline in the percentage of wilting plants, a decline which did not occur to the same extent in susceptible plants.
Resistance was shewn to be an inherited character, manifested in the varieties Iowa King, Iowa Belle and Pride of Muscatine, which proved to be suitable parental stock for the transmission of resistance when hybridized with susceptible stock. It has been found that a greater resistance was secured by back-crossing the F_1 to the resistant parent ; this was followed by inbreeding the segregates for three to four generations.

344. WALKER, M. N. 635.615–2.484–1.521.6:575(75.9)
A wilt-resistant watermelon for Florida.
Bull. Fla Agric. Exp. Sta. 1936 : No. 288 : Pp. 13.
By growing on land infested with the wilt organism, *Fusarium niveum* E.F.S., at the Field Station, Leesburg and selecting wilt-resistant strains with good fruit characters, the new variety Leesburg has been developed. It has been produced from the variety, Kleckley Sweet and it is an improvment on that variety not only in respect of wilt resistance but also on account of its tougher rind and lighter colour.
Some crosses have also been made and it is hoped that further valuable forms may be obtained from these.
Reasons are given to shew that the introduction of a wilt-resistant variety is unlikely to lead to over-production of water melons.

345. HUTCHINS, A. E. 635.622:581.47:575.11.061.6
The interaction of blue and green color factors in Hubbard squash.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : p. 514.
Results in F_1, F_2 and back-cross populations of a cross between a blue and a green strain of the Hubbard squash (*Cucurbita maxima*) indicated that there is a single factor difference between these two colours and that green is only partly dominant to blue.

346. ERWIN, A. T. 635.624 *Cucurbita moschata*
Notes on Cucurbita moschata, Duch.
Iowa St. Coll. J. Sci. 1936 : **10** : 213–21.
From different considerations it is concluded that *C. moschata* is a real species, its most constant distinguishing characters being the fimbricated or thread-like wavy margin of the seed and the tomentum of the vines and leaves.

347. 635.63:575.11
TKACHENKO, N. N. 635.63:575.242
(Preliminary results of a genetic investigation of the cucumber—*Cucumis sativus* L.).
Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 311–56.
A review is given of the literature on the genetics of the cucumber and the features which facilitate and complicate genetical studies with this plant are enumerated. The author has examined over twenty thousand plants annually. The various types occurring in the cucumber are described and their area of occurrence in the U.S.S.R. are indicated. Crosses were made between different types.
In crosses of the West-Asiatic group with smooth fruit and the East-Asiatic group with rough fruits the F_1 was intermediate in type and a 1 : 2 : 1 segregation was obtained in F_2. All the characteristic features distinguishing the two groups were inherited as a block. Similar results were obtained on crossing a peculiar variety with warty ripe fruits and yellow, transparent, wax-like skin, except that a certain proportion of dwarfs were obtained in the F_2, shewing the variety to be genetically somewhat distant. It is therefore regarded as a distinct variety, *C. sativus* var. *tuberculatus*. Reticulation of the fruit was inherited independently of the other complex of factors.

Fruits with white spines invariably proved also to have white fruits when ripe and all other colours of the two were identical. The white spined types are never reticulate. The black type was dominant in crosses and monohybrid segregation occurred in the F_2. In certain crosses the black types were reticulate and the white smooth but in other combinations no reticulate forms appeared in either F_1 or F_2 and further studies are being made on the inheritance of this character.
Sparse distribution of spines was dominant to dense and also monofactorial. In a not inconsiderable number of cases occasional plants with dense spining appeared among pure bred sparse lines and occasional chimaeras also occurred. The phenomenon is taken as an illustration of the frequency of mutation in this character.
Another mutant occurred which in plant characters and the male flower was identical with the original but bore small fruits resembling a large gooseberry in form. It is therefore named variety *grossularioides*. Among its several enumerated characteristics is a tendency for the fruit to split, as in wild cucumbers. In crosses with the normal the hybrids were intermediate or somewhat closer to the normal ; the three types appeared in the F_2 in the proportions 1 : 2 : 1, all the characters of the mutant being inherited as a block. The mutant fruit is yellow in colour and also free from reticulation. Reference is made to a similar mutant obtained by Lazarev (unpublished) in another cucumber variety Galakhov, systematically quite distinct from the present variety.
Another peculiar type found was one with hermaphrodite flowers in the proportion 3☿ : 3♂ : 1♀ on the same plant. One of these plants occurred in the " gooseberry " mutant. The fruits, when formed, from the hermaphrodite flowers are very small and peculiar but produced normal seeds which do not transmit the abnormality. This type is compared with the American variety Lemon, which has hermaphrodite and male flowers and it is pointed out that the development of a rudimentary ovary in male cucumber flowers is a not uncommon phenomenon. The association of the undesirable fruit form with hermaphroditism constitutes an obstacle to the use of these forms for breeding self-fertile cucumbers. A further group was found in which some of the plants had a large excess of female flowers, instead of the usual preponderance of males. Crosses between these two types shewed the female type to be determined by one dominant factor. The two types differ in a number of other characters, the female type being lower in yield of fruit ; it may be of use, however, in creating a true diœcious form for use in producing mass F_1s for utilizing heterosis.
Inbreeding revealed the existence of a number of other characters. Certain plants with pale yellow flowers were found and proved to be recessive to normal deep yellow. One factor, named *O-o* (orange), was concerned and it is possible that the recessive arose by mutation. The character first leaves opposite as opposed to alternate is dependent on at least three factor pairs. At least one factor causing variegation was detected and another mutant was observed, characterized by entire sterility and abnormality in a number of other characters. It developed fruits by parthenocarpy.
The various groups of characters shewing linkage, complete or partial, are enumerated.

348. HUTCHINS, A. E. 635.63:581.46:575.11.061.6
The inheritance of a green flowered variation in *Cucumis sativus*.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : p. 513.

The character concerned involves in addition to the production of a green corolla considerable enlargement of the reproductive organs, which on the female side results in complete sterility, though the male flowers function normally. In crosses with a normal strain the F_1 was normal and segregation into 3 normal : 1 green flowered was obtained in F_2.

349. 635.64 Nystate
SAYRE, C. B. 635.64:575(74.7)
Nystate, a new hybrid tomato, shows much promise adapted to both market garden and commercial cannery use, new variety gave highest yield in 1936 trial test with 30 other sorts—seed to be multiplied for 1937.
Fm. Res. Quart. Bull. N.Y. Agric. Exp. Sta. 1936 : **2** (2) : p. 9.

Developed by hybridization at the New York State Agricultural Experiment Station, Nystate has large, smooth, deep red fruit, ripening without green spots and having a high solids content owing to the large number of irregular locules (8 or 9) it contains. It is a heavy yielder and is especially desirable for canning.

350. YEAGER, A. F. 635.64:575.113.061.6
The uniform fruit color gene in the tomato.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : p. 512.
By crosses with the variety Bison the recessive gene for uniform fruit colour (absence of green stemspot) has been incorporated in some new commercially desirable varieties now being tested under the numbers 216–2–3, 215–p 2 and 209–2–10. These are characterized by great earliness, small determinate vines, red flesh, ordinary commercial size, uniform colour and resistance to heat and drought.
It is considered that the uniform colour is likely to be of great value in tomato breeding ; no linkage with undesirable characters has yet been observed.

351. SCHLÖSSER, L.-A. 635.64:581.466:575.11
Genetik und Entwicklungsphysiologie einer Blütenmissbildung bei der Tomate. (**Genetics and developmental physiology of a floral malformation in the tomato**).
Z. indukt. Abstamm.-u. VererbLehre. 1936 : **71** : 305–21.
The flowers of a yellow-fruited wild tomato race shewed a marked malformation of the calyx which consisted in the development of each sepal into a leafy structure, the whole with a $^{3}/_{5}$ phylotaxis. This occurred only in the first inflorescence and in this out of an average of 8–10 flowers only one developed, the fruit being surrounded by a crown of " leaves."
The F_1 shewed a range of types from almost normal to the most extreme form.
A genetical analysis revealed the presence of two recessive genes and provided an unusual case of localized effect.
Experiments on the effect of changes in the external medium on the genes shewed that it was possible to control, in part, their expression.

352. 635.65(47)
633.85(47)
(**Regionalization of varieties of leguminous and oil crops**).
Lenin Acad. Agric. Sci., Inst. Pl. Ind. Var. Testing Service 1936 : Pp. 105.
Descriptions are given of the main varieties with indications of their origin and systematic position, for all the main leguminous crops including beans (*Phaseolus*), lentil, gram (*Cicer arietinum*), vetch (*Lathyrus sativus*) and soya bean. In addition to the morphological characters the descriptions include indications of the yield, time of maturity, disease resistance and quality of the varieties. For each region in the Soviet Union recommendations are given of the varieties most suitable. Similar information is given for the oil crops sunflower, castor oil, groundnut and safflower.

353. 635.652 Mulatinho
635.652 Preto
LÖBBE, H. 635.652:575.42(81)
Os feijões Mulatinho e Preto. (**The beans Mulatinho and Preto**).
Minist. Agric. Dep. Nac. Prod. Veg. Rio de J. 1935 : Secção Technica No. 4 : Pp. 31.
A description is given of these two varieties of *Phaseolus vulgaris* which, though having coloured beans, are the best varieties so far tested. The importance of seed selection is emphasized and hints for carrying it out are given.

354. 635.652:551.566.3:581.143.26.03:575
VASIL'EV, A. S. 635.655:551.566.3:581.143.26.03:575
(**Production of bean varieties for the northern regions of the U.S.S.R.**).
Bull. Appl. Bot. Leningrad 1936 : Ser. A (18) : 43–50.
Examinations of about two hundred varieties of *Phaseolus vulgaris* grown under conditions of reduced (10 hour) illumination shewed that many of the forms were distinctly favoured in their reproductive development by this treatment. The majority of the Mexican varieties and many commonly grown European forms shewed this short-day reaction. A large group of other

varieties displayed a neutral photoperiodic reaction, whilst still others shewed a long-day reaction, though only two varieties of this type were observed.
From among the varieties whose development was most accelerated by short day, the most productive were selected ; these will be crossed with the earliest of the neutral varieties, which are capable of producing a good yield under northern conditions because of the rapidity of their second developmental stage, the photo-stage. The seedlings obtained from hybridization, the technique of which is described, are grown in continuous light and the plants which come into flower first are selected.
By doing this in the greenhouse at least two generations a year can be produced. From such crosses plants were produced which in 1935 flowered two days earlier than the neutral parent when grown in the open.
Observations on soya bean varieties gave essentially similar results and the same method of crossing is to be applied for the creation of productive forms capable of maturing in the north.

355. Lamprecht, H. 635.652:575.11.061.6:581.48:581.46
Zur Genetik von *Phaseolus vulgaris*. XIII. Ein neues Grundgen für Testafarben, ein weiteres Testafarbgen sowie etwas über Blütenfarben. (**On the genetics of *Ph. vulgaris*. XIII. A new basic gene for testa colours, a further gene testa colour and also some information on flower colours**).
Hereditas, Lund 1936 : **22** : 241–68.
A new seed type, termed *griseoalbus*, was analysed genetically. Its pale greyish white seed coat and only slightly coloured hilum margin were found to be determined by a recessive factor *gri*, which inhibits the development of seed coat colour unless present in the dominant form. In certain genotypes it produces pure white seeds.
Evidence is also presented for a new factor pair *Ins-ins* for seed coat colour, having the same effect as *J–j*, i.e. producing " raw silk yellow " in the dominant condition.
A new flower colour termed pale laelia was also studied. In *GriGri* lines this behaved as a simple dominant over white, but in *grigri* lines there was a great deficiency of individuals with coloured flowers, suggesting that *Gri* is necessary for the development of pale laelia in most genotypes. The gene for producing this flower colour is probably identical with that for producing a corona on the seed coat, *cor*. It is also suggested that it may be a member of the multiple allelomorph series *V—vlae—v* (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 1435) in which case it would be named *vpal*.

356. Lendner, A. and Schreiber, F. 635.652:581.04:575.243
De l'influence de l'alcool éthylique sur l'hérédité du haricot (*Phaseolus vulgaris*). [**The influence of ethyl alcohol on inheritance in the bean** (***Ph. vulgaris***).]
Bull. Soc. Bot. Genève 1936 : **26** : 103–15.
The stigma of a variety of French beans was treated with 90 per cent alcohol to destroy any pollen that might be present and pollen from another species was then used to effect fertilization. The F_1 progeny was normal but in the selfed F_2 there was segregation with normal and abnormal plants in a 3 : 1 ratio and segregation continued in the F_3. The recessive forms, which are described, were so misshapen that they failed to survive more than one-and-a-half months and their presence is held to be due to the original application of alcohol.

357. Dittmer, E. E. 635.652–2
(**Bean diseases**).
Lenin Acad. Agric. Sci., Inst. Pl. Ind. Var. Testing Service 1936 : Pp. 43.
The diseases of *Phaseolus* are dealt with in groups according to the causal agency, the main symptoms being described and illustrated for the benefit of breeders concerned with the production of resistant varieties.
A chart is provided for the identification of the diseases by means of the symptoms.

358. 635.652–2–1.521.6:575"793"
JENKINS, J. M. (Jr.) 635.652:575.116.1"793"
The development of early stringless beans by hybridization and selection.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 515–17.
The variety Tennessee Green Pod is the earliest and most productive bean under South Carolina conditions but has rough, very flat, broad and distinctly stringy pods and is susceptible to mosaic and root rot. To combine its earliness and productivity with good quality, crosses have been made with seven other varieties of good quality and selection for pod type and earliness carried out in F_3 and later generations. There appears to be some linkage between earliness and stringiness and out of 7000 early plants only 9 proved to be stringless and good in quality.
Several selections have now been obtained, which have yet to be tested for disease resistance and yield.

359. 635.655 Kingwa
635.655 Pekwa
GARBER, R. J. 635.655:001.4
Kingwa soybeans.
J. Amer. Soc. Agron. 1936 : **28** : 457–59.
Two strains of soya bean produced by the West Virginia Agricultural Experiment Station by pure line selection from the commercial variety Peking and named Pekwa and Kingwa respectively are very difficult to distinguish and are very similar in yielding ability. Pekwa has a slight advantage in uniformity and erect growth habit but Kingwa is the better known strain, being well established in southern Indiana, while Pekwa is confined to certain sections in West Virginia. In view of their great similarity it has been decided to give Pekwa the name of Kingwa and discontinue distribution of the strain formerly known as Kingwa, thus combining the better strain with the better-known name.

360. SVENSSON, V. 635.656:575.1
Brytärter. (**Brittle peas**).
Weibulls Ill. Årsb. 1936 : **31** : 35–37.
An account of a sugar pea known as Kungsärt (King pea) with a pod resembling a field pea. It has been crossed with Witham Wonder in an attempt to produce a King pea type with marrow pea seeds, which should be an ideal sort for household use and it is hoped that it will be on the market next year.

361. 635.656:575.11.061.6
FEDOTOV, V. S. 635.656:575.127.2
(**The genetics of anthocyanin pigmentation in peas**).
Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 163–274.
By growing the seedlings in hotbeds and later transplanting it was possible to obtain large numbers of seeds from an F_1 plant, as many as 1,000 being obtained from some hybrids. In this way large F_2 families of all combinations were obtained.
As regards flower colour *A* is a basic factor for the formation of anthocyanin in any part of the plant and in its absence (*aa*) all other factors influencing pigmentation are ineffective. *A* acting alone, however, produces no pigmentation. Another basic factor is B_1, in the absence of which many, though not all, other pigmentation factors are also ineffective : for its manifestation it is dependent on *A* and partly on A_m, the combination AA_mB_1 giving pink flowers.
The double recessive (bbb_1b_1) invariably has white flowers. Linkage was established between the factors B_1 and *B*, with a cross-over value of 5·4 per cent. The presence of a third basic factor A_m in the dominant condition is also necessary for the formation of colour in the flower and for the manifestation of certain other factors, namely A_r, *B*, C_r and C_v but it has very little effect on the expression of the factor *D*. A factor C_r, whose effect was to reduce the intensity of pigmentation and to influence the distribution of the pigment in the wings and standard, was found to be identical with the factor A_p of de Haan. A further factor C_v occurs, increasing the intensity of

flower pigmentation and also dependent for its effect on the presence of *A*, A^m, *B* and B_1. A dominant factor for coloured keel has been found in a wild pea from Transcaucasia and designated *Kp* ; it is effective only in the presence of *A*, *B*, B_1 and C_r ; it also intensifies the colour of the entire corolla, while some of the other factors reduce the effect on *Kp* on the keel.

An examination of the factor A_r in combination with other factors shews that in the dominant homozygous condition its effect is to intensify the red shades, while the homozygous recessive ($a_r a_r$) intensifies the blue, the heterozygotes being intermediate. This is true of its effect not only on the flower colours, but on the colour of the pod, leaf axil and other organs of the plant and the general effect of this factor seems to be to increase the acidity of the sap. A similar difference was noted between the different combinations of *Bb*, the dominant families being characterized not only by greater intensity of anthocyanin but by a more bluish tint. Thus the most pronounced blue shade is produced by the combination $a_r P$ and the most pink by $A_r b$.

$D_w > D > d$ forms a multiple allelomorphic series governing leaf axil pigmentation, D_w producing a double anthocyanin ring, *D* a single and *dd* no ring ; the intensities depend on the other factors present.

P_1 determines pigmentation of the pod, *Z* the seed coat, *zz* having colourless seed coat ; it acts as a basic factor to all the other seed coat factors. A factor F_r, producing anthocyanin patches on the seed coat, was also found ; its effect was similar to that of *F*, with which it was linked, with 8.1 per cent crossing-over. The Abyssinian black-seeded pea when crossed with the European black-seeded gives hybrids with partial sterility and with seeds patched with black and grey. A violet seeded form from the Urals contained a dominant factor *Vl*, which in the heterozygous state also gave patched seeds ; this factor is hypostatic to the factor *U* in the European black-seeded pea. *Oh* determines the colour of the seed coat, dominants being greyish green and recessives reddish brown. *M* causes mottling in the colours produced by the *Oh* genes.

Thus of the twenty factors influencing anthocyanin pigmentation *A* is a basic factor for them all, A^m and B_1 are additional basic factors for the development of C_r, C_v, A_r and *B* ; B_1 also serves as a basic factor for P_1 and D_w—*D* and also for F_s, *F*, *Vl* and *U*. Furthermore, *Z* acts as a basic factor for F_s, *F*, *Vl*, and *U* and for *Oh*. None of the factors has any effect when acting alone and all are very much influenced in their effect by the combination of other factors present with them. A schema is provided in illustration of the interaction of the various factors. Some of them also influence other characters, e.g. *A* and *B* in combination with other factors influence the shape of the seeds and *A* in conjunction with certain other factors influences the vegetative period. The stage of development of the plant at which a character is manifested, and the period of time during which it continues to be manifested, are different for the different factors. The presence of certain genes, however, can be detected by microscopic examination at a time when they have still had no effect upon the macroscopic appearance of the plant.

The inheritance of the same characters in interspecific crosses was also investigated. Crosses between *P. sativum* and *P. elatius* behaved in all respects like interracial crosses. *P. abyssinicum* gave a rather high degree of sterility and proved to be a distant cross ; there was a wide range of flower colours, with numbers of transitional types, evidently owing to the presence of polymeric intensifying factors in the Abyssinian species.

Still more pronounced sterility was found in the cross *P. sativum* x *P. humile* ; the hybrids had purple flowers and anthocyanin ring in the leaf axil even though the parent forms were colourless, owing to the presence of the basic factor *A* in *P. humile*. Many transitional shades were observed in F_2, owing to the presence of modifiers in *P. humile*, mostly tending to produce a reddening of the shades.

Still more remote from *P. sativum*, according to its behaviour on crossing, is *P. fulvum*. One of the segregates resembles the cream-purple Afghan pea, giving a possible clue to the origin of this. Since all the species have seven haploid chromosomes their evolution must have proceeded along the lines of factorial mutation. Seven of the dominant anthocyanin factors studied have been found only in cultivated species, the wild forms bearing the corresponding recessives. These factors have apparently arisen by dominant mutation and it is calculated that 35 per cent of the mutations have been of this type.

Crosses were also made between races of *P. sativum* from different countries, and their factorial composition thus established. The Afghan forms are the nearest to the wild peas except that all

are without anthocyanin ring (*dd*) and have the dominant factor *M*. Only one form without *A* was found ; the dominant *Fs*,which is not observed in wild peas, occurs in this group.
Some of the Indian peas resemble the Afghan ones, others resemble Abyssinian or other forms. A characteristic feature of the Abyssinian peas is the presence of a double ring (D_w). Two other factors appear in the dominant form which in the wild races are recessive, namely *D* and *Vl*. Most factors are present in the dominant form, even in the white flowered varieties, which are only recessive for the factor *A*. The factors *M* and *Fs*, for mottling and streaking of the seeds, are absent, as are also P_1 and *U*.
The Mediterranean peas, though predominantly recessive, are characterized by the presence of certain interesting dominants such as P_1, *Fs* and *U*.
The various dominant factors which appear in the cultivated and not the wild forms are never found all in the same form and it is concluded that they have originated at different times and places by independent mutation. The same is true of the various recessive factors distinguishing the cultivated forms.

362. 635.656:575.113.3
FEDOTOV, V. S. 635.656–2.112–1.521.6
(Multiple allelomorphs of the character "grey spotting" on the foliage of peas).
Bull. Appl. Bot. Leningrad 1935 (1936) : Ser. II (9) : 275–86.
In addition to the common form with grey speckling on the leaves and stipules, certain forms were found in Transcaucasia with a very pronounced speckling. Both these types gave monohybrid ratios when crossed with a form free from all speckling. Both the factors determining this speckling proved to be linked with *Pl* (black hilum). The new type of pronounced speckling also proved dominant to the old ; it was designated Fl^w, by analogy with ordinary speckling *Fl*, with which it therefore constitutes a multiple allelomorphic series.
The occurrence of multiple allelomorphs suggests that the varying degrees of grey speckling have come into existence by successive mutations, other allelomorphs being supposed to exist. The Transcaucasian form has probably arisen by dominant mutation. The greyness is caused by a layer of air in the leaf tissue, which in hot climates such as that of Transcaucasia serves as a protection against damage by heat. It is for this reason probably that it has been selected in nature to the exclusion of the normal form and the type should be of interest in breeding for drought resistance.

363. WINGE, Ö. 635.656:575.116:581.48
Linkage in *Pisum*.
C.R. Lab. Carlsberg, Copenhagen 1936 : Sér. Physiol. **21** : 271–393.
A descriptive list of the seventeen genes worked with is given, with the synonyms attached to them by other workers, then after a list of the lines used and of the methods of calculating cross-over values the results of 140 crosses are given with the calculated cross-over percentages. These represent 120 of the 136 possible combinations and provide evidence for twelve cases of linkage, one of which was previously known.
All the available evidence of linkage in *Pisum* is utilized in the provisional mapping of linkage groups, which number eight, one more than the number of chromosomes.
An investigation was also made into the question of linkage between factors for seed weight, which is determined by the mother plant, and known genes. Such linkage was established in the case of the factor *I* (yellow cotyledon) and probably *Pl* (dark hilum). Cases in which seed weight was affected by pleiotropic working of qualitative genes were also noted. In general it appeared that the genes affecting seed size influence the linear dimensions of the seed, that is, the cube root of the weight.

364. ATABEKOWA, A. J. 635.656:576.312.36:537.531
(The action of X-rays on the seeds and seedlings of peas).
Biologičeskii Žurnal (Biologicheskij Zhurnal) 1936 : **5** : 99–116.
The somatic chromosomes and the process of mitosis were examined in untreated material of

Pisum sativum and are described and illustrated. The results agreed rather closely with those of Levitsky. Root tips were then examined from seeds subjected to various doses of X-rays. The lower doses tended to increase the proportion of cells with more than one nucleus and also to increase the yield of the resulting plants. One cell with four nuclei, giving the appearance of a tetrad, was observed. There was also a tendency for the chromatin to be broken up into very small fragments and a reduction in length of the chromosomes. These effects were very slight in the lowest dosage of 1,000 r, and increasingly more pronounced with 8,000, 12,000, 18,000 and 24,000 r. Higher doses greatly reduced the viability of the seeds and vaused further chromosome aberrations such as translocations and entire deformity of the chromosomes.
The effect of a dose of 250 r on young seedlings corresponded largely to that of 1,000 r on the seeds except that the number of polyploid cells was much greater, as was also the increase in yield.

365. 635.656:576.356.5:578.08
635.651:576.356.5:578.08
BEREZINA, N. and ENIN, T.
(Production of polyploid forms of *Vicia sativa* L. and *Pisum sativum* L.).
Trudy Sel'skokhozjaistvennoi Akademii im. K.A. Timirjazeva (Trans. K.A. Timiriaseff Acad. Agric. Moscow), 1936 : **1** : No. 3 : 164–72.
Decapitation experiments were performed in 1932 with *V. sativa* and also with *V. Faba* and *V. narbonensis* but without success in the induction of adventitious shoots. By centrifuging the seeds during germination, root tips were produced in which large numbers of binuclear cells were present, both nuclei being in the resting condition. No better success was obtained however with these plants on decapitation. Successful regeneration was attained only when a modified method was employed, consisting of decapitating and also removing the axillary and lower shoots when these began to develop, leaving short stumps of 0·5 – 1 cm. in height. Regenerated shoots were obtained by this method from 17 out of 138 plants of *V. sativa* and in 9 out of 197 plants of *P. sativum*. One of the *V. sativa* plants turned out to be a tetraploid.

366. 635.656:581.192.2:575.22
KNJAGINIČEV, M. I.
(Variation in the protein content of individual grains in different varieties of peas).
Bull. Appl. Bot. Leningrad 1935 : Ser. A (16) : 31–36.
A special method is described for iodometric determination of the percentage protein in a single pea without imparing its germinating capacity ; the samples are bored out of the peas with a dentists' drill, after which the peas are germinated on filter paper.
Analysis were made of samples of peas from pure lines of a number of varieties. The variation differed for different varieties, the marrowfat varieties having the greatest, especially American Marvel, and the split varieties such as Heines Viktoria the least variation. In the more variable varieties reliable determinations can only be made therefore by taking the average of a number of analyses from different seeds. In the less variable varieties the analysis of one single seed is regarded as reliable.
The greater variation within certain varieties may indicate that these varieties are not pure in respect of this character, selections having been carried out only for morphological characters. It may be, on the other hand, that these varieties are genetically so constituted as to have a greater variability.

367. 635.656:581.46
635.656:581.47
ALEXANDROV, W. G. and ALEXANDROVA, O. G. 635.656:581.48
[Anatomy of flower, fruit and seed of peas. (Essay of comparative anatomical study of the cultivated plants).]
Bull. Appl. Bot. Leningrad 1935 : Ser. III (9) : Pp. 152.
A full study was made of the internal structure of the reproductive organs of the peas of the world, flower, peduncle, fruit and seed characters being analysed. The species and forms occurring in the primary centres of distribution of Afghanistan and Abyssinia are characterized by the possession of a number of dominant characters not usually appearing in other forms.

Among these characters are the presence of large numbers of chlorophyll grains in the petals, of very intense, concentrated and durable green pigment in the seed coat, mottled pattern of the seed coat and occurrence of all known patterns, black or dark brown hilum, small, regular starch grains of sharply defined form, and several others. The distribution of the pigments in the different layers of tissue is also characteristic for the different groups.
The structure of the different organs in the various species and groups is described and illustrated in detail.

368. 635.67–2.7–1.521.6:575
633.15–2.7–1.521.6:575
POOLE, C. F.
New sweet corns resistant to earworm.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 496–501.

To test whether the differences in resistance to earworm occurring between varieties (Cf. " Plant Breeding Abstracts " Vol. VI, Abst. 309) were real or merely due to different times of silking, a pair of experiments was arranged so that in one the varieties silked at different times according to their respective degrees of earliness while in the other they silked more or less concurrently. Significant varietal differences of the same order occurred in each experiment and a *t* test failed to shew any significant difference between paired observations from the two experiments. It is concluded therefore that the differences in susceptibility are really varietal.
Information on the inheritance of resistance was obtained from the back-crosses of F_1s between resistant and susceptible varieties to each parent. Marked differences were found to occur and there was moreover evidence of transgressive segregation, indicating that more than one back-cross to the resistant parent would be undesirable for the purpose of improving earworm resistance.

369. 635.67–2.7–1.521.6:581.46
633.15–2.7–1.521.6:581.46
BURK, E. F., CROSS, C. B. and HIXSON, E.
Variety tests of sweet corn and its resistance to corn earworm and smut injury.
Proc. Amer. Soc. Hort. Sci. (1935) 1936 : **33** : 502–04.

The behaviour of 39 varieties of sweet corn is reported. There was a direct relationship between tightness of husk and freedom from injury, but no apparent correlation between injury and percentage of husk or length of husk.

BOOK REVIEWS

Willcox, O. W. 33:631.557

Nations can live at home.

George Allen and Unwin, Ltd., London, 1935 : 10s. 0d. Pp. xi + 279.

Preoccupied with the problem of " the Malthusian bogey," presenting itself in the modern guise of ever increasing pressure of population on the soil, accompanied by a widespread demand by nations for a higher standard of living, the author endeavours to shew how the consequent international rivalry with its constant threat of war may be obviated by social economic reorganization, combined with the application of the new science of " agrobiologic dynamics " which is defined as " a real science of plant growth and yield by which all agrobiologic phenomena may be dimensioned, permuted, controlled, and brought to a finish with quantitative exactitude."

Three principles of agrobiology, namely, the constancy of genotypes, the definite measurable growth capacity of the individual agrotype and the definite effects of growth factors are examined to shew that " plant life, in any given closed system, can be dealt with as a constant, measurable quantity, and that growth factors can be dealt with as forces having definite and measurable magnitudes."

The author then applies the law of diminishing returns to plant cultivation and formulates a universal yield equation, while at the same time suggesting a method of conferring the maximum fertility on any soil, thereby creating what he terms " a perfertile soil." In order to ensure the maximum productivity of the land, use must be made of a perfertile soil in conjunction with perultra agrotypes, i.e. those that have as a result of natural selection or breeding attained the maximum of plant vigour and therefore produce maximum yields. The role of the geneticist and the plant breeder in evolving such perultra types from subultra agrotypes is mentioned *en passant*.

From the economic side the question of the chemical composition of various crops and agrotypes is touched upon with reference to food supply and the relation between yield and climate is discussed from the same aspect.

An appendix containing mathematical calculations bearing on the author's theories concludes the book.

Pirovano, A. 538.6:575.242

La parte della elettricità nella vita. (**The role of electricity in life**).

Casa Editrice O.M.I., Roma, 1934 : lira 46. Pp. v + 540. 171 figs.

The author begins with a theoretical consideration of electricity in relation to biology. The experiments made on various plants by electro-magnetic induction are described in illustration of the effect of electricity on the plant.

In the succeeding chapters an account is given of a large number of experiments made on various plants at different stages of development including the results of hybridizations made with treated pollen. Many of the remarkable mutations obtained are illustrated and photographed. Descriptions of many of these investigations have been previously published.

The final chapter is devoted to an account of the apparatus and how it is used.

Malygin, Ju. N. 575:633(47)

(**Breeding and seed production**).

Sel'khozgiz, Moscow 1935 : 3 roubles 15 kopecks : Pp. 311. 37 figs.

In this small Russian manual on plant breeding the author gives an outline of the main facts of inheritance, with special reference to agricultural plants. The principles of plant breeding are afterwards outlined and the different processes involved in successful breeding on modern lines are described and discussed, including a relatively full section on the methods of field testing and seed production.

575:633(47)
MEISTER, G. K. 63.00.15(47)
(The best varieties of grain crops of the Saratov Breeding Station).
Ogiz-Sel'khozgiz, Moscow 1936 : 5 roubles : Pp. 103. 3 figs. 7 pls. 2 maps. 36 photographs.

In this memorial volume on the work of the Saratov Breeding Station (now the Institute of Grain Husbandry) during the last 25 years, an account is given of the development of the station, under the directorship of G. K. Meister, from the time of the revolution to the present day. Among the achievements of the station are the production of drought-resistant and higher yielding lines of wheat and millet and of sunflowers resistant to the attack of *Orobanche*, rust and moth ; the two wheats Sarrosa and Sarrubra, obtained from crosses of *Triticum durum* and *T. vulgare*, have gained great popularity and in many places replaced *T. durum*. The production of agriculturally valuable rye-wheat hybrids gained considerable fame for the station ; the work of Tzitzin on the hybrids of wheat and *Agropyrum* was started at Saratov and hopes are still entertained that these hybrids will ultimately furnish a new wheat type of great practical value.
Milling and baking value in wheat have also received special attention and a further feature of the work of the station has been the application of inbreeding to cross-fertilized plants, especially to the sunflower, of which a number of selfed lines possessed of special characters are now available. These are being used for hybridization among themselves for the production of desirable combinations of characters ; wild perennial species possessed of great resistance to diseases are also being used for hybridization too.

The equally important practical aspects of successful breeding such as seed production and distribution have also received attention from the station.
Full descriptions are given of the main varieties of the different crop plants produced at the Saratov station, with illustrations and indications of their origin, agronomic qualities and main uses.
The volume is also provided with illustrations of the buildings and members of the staff and is a worthy memorial of one of the most outstanding of the many Soviet research stations in applied botany.

ALVERDES, F. 575.1
Grundzüge der Vererbungslehre. **(Outlines of genetics).**
S. Hirzel, Leipzig, 1935. Pp. viii + 143. 45 figs.

A book written for anyone who requires a rapid survey of the field of genetics and some idea of the basic principles of the subject.
Of the fourteen chapters, the last two are devoted to inheritance in man, the examples in the other twelve being drawn mainly from plants and animals.
In simple language (the genetical terms are given in brackets) the reader is lead from a general account of the cell and its part in reproduction and the conception of geno– and phenotype to a consideration of the laws of Mendel and the results arising therefrom.
The cytological aspects are confined to a shorter chapter on the chromosomes.
The book is illustrated by a number of clear diagrams.

DUNN, L. C. 575.1
Heredity and variation. Continuity and change in the living world.
Chapman and Hall, Ltd., London, 1936 : 4s. 6d. Pp. iv + 120. 47 figs.

CRAMPTON, H. E. 576.1
The coming and evolution of life. How living things have come to be as they are.
Chapman and Hall, Ltd., London, 1936 : 4s. 6d. Pp. iv + 103. 16 figs.

These are two books from a new series of popular expositions of scientific subjects, written by American workers. They are collectively entitled " The University Series, Highlights of Modern Knowledge."

In "Heredity and Variation" Professor Dunn gives a lucid account of the chromosome theory of heredity and expounds briefly some of its applications, to evolution, to plant and animal breeding and to eugenics.

"The Coming and Evolution of Life" by Professor Crampton is devoted, after an historical survey, to an account of the evidence for and the mechanism of evolution in animals. A noteworthy feature of the book is the closeness with which Darwin's ideas are followed, even to the extent of making no distinction between fluctuating and discontinuous variation.

The difficulty in writing popular books about scientific subjects seems to be to steer a course between the Scylla of being inaccurate and the Charybdis of being technical or involved. In some places these books sail perilously near Scylla but on the whole they give a well-balanced picture of the subjects as seen by their respective authors.

The books are well produced and printed and terminate with a suggested lists of books for further reading, a glossary and an index with pronunciations.

575.1:061.6(42)
576.312:061.6(42)

The John Innes Horticultural Institution 1910–1935.
University Press, Cambridge, 1936: Pp. 58.

To commemorate the end of its first quarter of a century of work, the John Innes Horticultural Institution has published a booklet embodying a summary of the chief lines of investigation pursued and a record of the men and women who have worked at the Institution.

The larger part of the work has of course been primarily of theoretical interest and has comprised genetical and cytological research on a wide range of plants and some animals. Much of it is now classical and too well known to need summarizing here.

Perhaps the best known work at the Institution of direct practical importance is the work on fruit, which includes investigations on compatibility in pollination among apples, pears, plums and cherries, cytology and genetics of apples, pears and *Prunus* species, the breeding of apple stocks resistant to Woolly Aphis in conjunction with the East Malling Research Station, the breeding of new apple varieties, investigations on *Rubus* forms also leading to the production of new forms, and, to a less extent, work on gooseberries, currants and strawberries. Other economic plants dealt with include cereals, peas, flax, tomatoes, sugar beet, garden beet, mangolds, onions, leeks, potatoes, *Nicotiana* and maize.

The list of workers forms a most impressive array of names, while the bibliography of papers, books and communications covers over twenty pages. Also included in the booklet is a list of the present and past members of the garden staff, to whom not a little of the success of the work is due; this list includes the student gardeners and exhibitioners trained by the Institution.

In conclusion it may be said that while the booklet is an interesting and impressive record, the true monument to the work lies in the progress made by genetics and cytology in the last twenty-five years, no small part of which has been due to the activities of this privately endowed Institution.

RUDLOFF, C. F. and SCHMIDT, M. 575.11
Grundriss der Vererbungslehre für Gärtner. **(Outline of heredity for gardeners).**
Eugen Ulmer, Stuttgart 1935: RM. 2.60.† Pp. 103. 33 figs.

In this small manual the laws of inheritance are explained in popular terms, together with the attendant phenomena, cell division, sexual reproduction, sterility and so on, all illustrated as far as possible from the realm of horticultural plants. Only the more straightforward genetical phenomena are dealt with and the book might serve as a useful introduction to Mendelism for German readers.

† 25 per cent reduction outside Germany.

58(038)

Vocabulaire Français-Anglais des mots et locutions françaises employés dans le dictionnaire des genres de plantes phanérogames à l'exclusion des termes botaniques et autres mots dont la consonance ou l'orthographe est à peu près la même en français et en anglais ou en latin. (**French-English vocabulary of French words and phrases used in the dictionary of the genera of phanerogams, excluding botanical terms and other words which have approximately the same sound or spelling in French and in English or Latin**).

On sale by : Dulau and Co., 2, Stafford Street, London. Pp. 26.

This pamphlet which provides the English equivalents of numerous French words and phrases occurring in the " Descriptive and Synonimic Dictionary of the Genera of Phanerogamic Plants " issued in six volumes would be of use to students or research workers with no knowledge of or only a very slight acquaintance with the French tongue. The words are simply arranged in alphabetical order and, except in so far as such information can be derived from the English equivalents given, all information about gender, parts of speech etc., usually regarded as essential in a dictionary are omitted—not perhaps a disadvantage for the user whose knowledge is as scanty as the author of the pamphlet evidently assumes.

Though it might be supposed that a work of 26 pages and representing only a selection would cover only a relatively small part of the vocabulary that might be required, a considerable number of useful botanical and other terms have been included and the translations in general are apt and avoid the pitfall of literal translation based upon the similarity of sound. One exception however is the word " *nerve* " which appears as the translation of " nerve " although " *nervure* " is correctly translated as " venation."

The publication will be most profitably used by those who have some little knowledge of the elements of French grammar.

581

HILL, J. B., OVERHOLTS, L. O., and POPP, H. W. 575.1

Botany. A textbook for colleges.

McGraw-Hill Publishing Co., Ltd., London, 1936 : 24s. 0d. Pp. xiii + 672. 1 pl. 335 figs.

Perhaps the most notable feature of this newly published textbook of botany is that it has already been used for several years in mimeographed form and has undergone several revisions. Though the preface states that the book comprises the subject matter of a two-semester course in botany, it actually contains a good deal more material than is usually included in a first year course in England.

Part I deals with the structure and physiology of seed plants and diverges considerably from the form usually adopted in botany textbooks, for the physiological matter is interspersed among the anatomical ; thus chapter IV deals with the anatomy of leaves and transpiration and chapter V with food synthesis, chapter VI with roots and chapter VII with the absorption of water and inorganic salts, chapter VIII with stems and chapter IX with growth and movement, and so on, the relation between structure and function being thus shewn. At the same time, however, this plan results in the separation of subjects which some may consider to be more suitably treated together ; for instance absorption and transpiration, the two aspects of the water relations of plants occur rather widely apart. The remaining chapters of this part deal with flowers, with fruit, seeds and seedlings and with digestion, respiration and fermentation.

Part II is devoted to a rather full account of the plant groups, except for the last chapter, which contains a brief account of the chromosome theory of heredity.

There are two minor points which deserve mention : the illustrations are nearly all new, and established technical terms are not avoided.

Although the book is not absolutely free from errors, it shews in many ways evidence of careful preparation. Its production is typical of the McGraw-Hill series and it is furnished with a comprehensive index.

JAMES, W. O. and CLAPHAM, A. R. 581.162
The biology of flowers.
Clarendon Press, Oxford 1935 : 8s. 6d. Pp. viii + 116. 71 figs.

In the form of a book designed, it is stated, for a laboratory manual, the process of reproduction in the Angiosperms is described and the development of all the floral organs is described and illustrated in detail. The different methods of pollination and different forms of fruit are examined in detail and about 30 examples of flowers representing different orders and species are drawn and described separately. The book is beautifully illustrated and terminates with a table shewing the insect visitors of all the flowers described and with a glossary of the terms used.

FILZER, P. 581.5
Pflanzengemeinschaft und Umwelt. Ergebnisse und Probleme der botanischen Standortforschung. (**Plant communities and environment. Results and problems of the botanical investigations on habitat**).
Ferdinand Enke, Stuttgart, 1936 : R.M. 5.† Pp. vii + 98. 19 illus.

This small book has been produced with the object of making some of the results of modern studies on ecological plant geography available to a larger public. The five chapters deal with the plant life in desert lands, illustrated from the author's own investigations in the Sahara ; in a German beech wood ; in the mountains ; by the sea and finally the life of sea algae.
No great demands are made on the botanical knowledge of the reader but at the same time the more difficult ecological problems are not avoided.
Some original photographs illustrate the work.

OVERBECK, F., and OVERBECK, H. 581.9(43)
Mittelgebirgsflora. Die charakteristischen Bergpflanzen Deutschlands. (**Sub-alpine Flora. The characteristic alpine plants of Germany**).
J. F. Lehmanns, München, 1935 : R.M. 7.† Pp. 112. 188 col. illus. in 33 pls. 13 figs.

Beginning with ferns, equisitums and lycopods, the book goes on to describe and illustrate the flowering plants of the German mountainous regions. Each plant is attractively illustrated in colour and the descriptions are in non-technical language.
With the aid of this flora the wanderer in the sub-alpine districts should be able easily to identify the plants that cannot fail to attract his attention and interest.

LEWIS, F. 581.9(54.9)
The vegetable products of Ceylon. (A guide to their identification and economic uses).
The Associated Newspapers of Ceylon, Ltd., Colombo, 1934 : 15s. 0d. Pp. vii + 402.

The classification followed in this work is that of Trimen's " Flora of Ceylon " and the work deals with those trees and plants of economic use found in Ceylon. Though the grasses are not included as a whole a few of the most important are briefly described.
Special attention is paid to the leaves and as flowers are not always available it is hoped that in many cases identification may be possible by means of the leaf characters.
The English and vernacular names are given wherever they are known.

EAMES, A. J. 583.1
Morphology of vascular plants. Lower groups (Psilophytales to Filicales).
McGraw-Hill Publishing Co., Ltd., London, 1936 : 24s. 0d. Pp. xviii + 433. 215 figs.

No one is better qualified than Professor Eames to assess the vast quantities of new knowledge that have accumulated during recent years on the primitive groups of vascular plants leading to many and radical revisions of the prevailing views on that much debated question, " the origin of the vascular plants." This he has done in the book before us, which presents a full and detailed

review of the primitive vascular plants starting from Lycopodiales and working upwards. For the convenience of the student the living forms are described before the fossils but the relationships are discussed as the different groups are approached, and the problems of phylogeny and classification are dealt with in the final chapter, together with the various other problems connected with the origin of the higher plants, the origin of the vascular structure and the alternation of generations.

63.00.15(47)
575:633(47)

UGRIMOFF, A. I. v.
Die wissenschaftliche Planung des Pflanzenbaues in Russland. (**The scientific planning of agriculture in Russia**).
Landw. Forschungsbibl. Oststaaten, Berlin 1935 : Pp. 109.

The author attempts in the first place to shew that planning of agriculture is no new thing in Russia, having been started long before the Revolution, in fact in 1894 by Kostyčev, since when there has ever been the tendency to divide the country up into zones each served by a certain number of research organizations. The further development of this zonation and the establishment of the various zones into which the country was later, in post-revolution times, divided according to climate and type of vegetation, and the problems with which the authorities were faced in connexion with raising the production in each of these zones, are outlined in general terms. The two main problems for immediate solution are the extension of cultivation towards the north and into the arid zones of the south east. This the Soviet botanists are attempting to do by the introduction of new crops and new varieties of the existing crops, and, on the assumption that the physiological limits are not yet reached, by the production through hybridization of forms possessed of greater resistance to cold and to drought respectively. A further goal is to produce crops and varieties suitable for each one of the many zones, so that in place of the old uniformity a state will soon be arrived at in which each area will be possessed of its own special highly adapted varieties of the crops that it is best suited to produce. Here again the plant breeder plays a role of primary importance and the achievement of the goal will depend both on the improvement of existing crops and the introduction of new ones adapted to special areas. Sorghum, soya bean, cotton and various new fibres such as *Apocynum*, *Abutilon* and others, and rubber plants such as *Scorzonera tau-saghyz* and others are among the main crops that have been introduced or whose cultivation has been extended.

The problem of bringing the arctic zone, of which so much of the Soviet Union consists, into cultivation is of special importance and a separate section of the book is devoted to the development and results of the arctic research station at Khibiny (Chibiny). In this connexion special mention is made of the success of potato cultivation and breeding in the arctic zone and of the production of oats and other cereals capable of growing there successfully, by means of hybridization between extremely early northern forms and more productive varieties from the neighbourhood of Leningrad.

The new lines of plant breeding applied by the Soviet workers, consisting in enlarging the range of variation of initial material by extensive collections of world material on the one hand and distant hybridization and other genetic methods on the other,* are described and a list of institutes and academies concerned with this work is given. Special reference is made to the extensive work on interspecific and intergeneric hybridization in a great variety of crops, including the work of Michurin, some of whose results however are referred to somewhat sceptically, and a full review is given of the recent work on *Triticum-Agropyrum* hybrids and on the new wheat species found in Georgia.

Each section of the book is supplemented by a list of the relevant literature and the work represents one of the first attempts to give a full outline in the German language of the many lines of advance being pursued by Soviet breeders at the present time.

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* See "Plant Breeding in the Soviet Union," Imperial Bureaux of Plant Genetics, Cambridge and Aberystwyth, 1933.

KRIEGER, L. C. C. 632.4

The mushroom handbook.

The MacMillan Company, New York, 1936 : 15s. 0d. Pp. xiv + 538. 32 pls. 126 figs.

A popular book written with the object of interesting the general public in the fungi and especially to enable the layman to recognize the edible species. After some general remarks on their botanical features, habits and distribution, on the edible and poisonous kinds and the growing and cooking of mushrooms there follows a classification and key to the more common genera of the *Ascomycetes* and *Basidiomycetes*.

The more conspicuous species are then described in detail.

There are a number of excellent coloured plates and photographs and the book is provided with a bibliography, glossary and index.

MARTIN, H. 632.9

The scientific principles of plant protection with special reference to chemical control.

Edward Arnold and Co., London 1936 : 2nd Ed. 21s. 0d. Pp. xii + 379.

In his foreword to this exhaustive work on plant diseases, the second edition of which has just been published, Sir Daniel Hall makes it clear that the object of the study of plant diseases, just as the science of medicine, is to keep the subject in health rather than to treat its ailments. One of the many ways of doing this, and one which is ever gaining in popularity and importance, is the breeding of resistant varieties. It is for this reason that, after a brief introduction on the general types of plant disease and the different methods of control, the author starts off immediately with a discussion of the phenomena of resistance, its inheritance and the methods of breeding varieties resistant to both plant and animal pests. Following upon this the various other methods of control are outlined.

Each chapter is divided into sections, with a list of literature for each section, and the book terminates with a useful subject and author index.

FLAKSBERGER, C. A. 633.11

(**Flora of cultivated plants. I. Cereals. Wheat.**)

State Agricultural Publishing Company, Moscow, Leningrad 1935 : 10 roubles : Pp. xiv + 434. 127 figs. 6 maps.

The collective studies of the world resources of all the main cultivated plants made in the Soviet Union during the last few years have placed at the disposal of Soviet botanists a fund of information hitherto unparalleled in its extent, exhaustiveness and accuracy and has put the Soviet workers in an unique position to survey the crop plants of the world in all their diversity and to pronounce opinions as to their genetic variation and possibilities, their systematics and their origin. This information is being brought together and published in the form of a series of monographs entitled " Flora of cultivated plants," under the editorship of Professor E. V. Wulff ; the first volume is appropriately devoted to wheat and twenty further volumes are planned.

The present volume starts with a brief outline of the systematics of the *Gramineae* by R. J. Rozhevits, with keys for the determination of the different systematic units. The genus *Triticum* is then dealt with in detail by K. A. Flaksberger, the more general matter having been treated in an earlier volume (see " Plant Breeding Abstracts," Vol. VI, p. 455).

The systematics of the genus are discussed and the various species and their distinguishing features are described, with notes on their geographical distribution, their subdivision into varieties with keys for the determination of these latter, and descriptions and illustrations of the main ones.

Wild as well as cultivated species are included and the book constitutes one of the fullest and most detailed reviews of the systematics of the genus *Triticum* yet published ; not the least valuable feature of the volume is the extensive bibliography with which it concludes, and which covers some thirty-five closely printed pages.

633.11:664.641.016(49.4)

Erste Schweizerische Qualitätsgetreideschau 1936. (**The first Swiss high quality wheat show 1936**).
Zürich, Tonhalle-Pavillon, 24.-26. April : Burgdorf, Markthalle, 30. April-3. Mai 1936 : Pp. 69. 2 figs. 3 tables. 2 illus.

This small booklet contains the reports of the papers read at the wheat show at Zürich in April, 1936. The object of the show was to encourage the home production of high quality wheat in Switzerland. Among the papers read, together with a number of a more general nature, were included a review of the methods of determining baking quality by Dr. S. Wagner, entitled " Untersuchung und Bewertung der Weizenqualität," and an account of Swiss cereal seed production by A. Schnyder entitled " Die Entwicklung des Saatzuchtwesens und der Saatgutversorgung im schweizerischen Getreidebau."

Snowden, J. D. 633.174

The cultivated races of sorghum.
Adlard and Son, Ltd. London 1936 : 10s. 6d. Pp. vii + 274. 31 figs.

The botanical history of the cultivated sorghums is traced and an examination made of the various systems for their classification with the result that Stapf's system of giving the status of species to the more distinct types is adopted and extended to include a number of types not known to Stapf when his monograph was published in 1917.
The genus Sorghum has therefore been divided into two well-marked sections *Eu-Sorghum* and *Para-Sorghum* and the former is further divided into the two sub-sections (A) *Arundinacea* with the series *Spontanea* and *Sativa* and (B) *Halepensia*.
The species are each fully described and illustrated as well as their varieties and forms and finally there is a short section on the relationships of the wild and cultivated sorghums. The bibliography includes nearly 500 titles and there is an index to the botanical and the vernacular names.
This work should help materially to clear up the confusion that exists between the agricultural and botanical forms of this most important genus.

Michurin, I. V. 634:575.127

(**The results of sixty years' work**).
Sel'khozgiz, Moscow 1936 : 25 roubles : Pp. lxiv + 491. 32 pls. 239 figs.

A new edition of I. V. Michurin's classical work has been issued incorporating a number of extensions and additions. It contains an account of the life and work of this remarkable plant breeder and an introductory article of appreciation by T. D. Lysenko. The body of the work is on the same lines as the original volume (see " Plant Breeding Abstracts," Vol. V, p. 376), though a great many more of his new hybrids are described. The descriptions are supplemented by a number of excellent illustrations, the majority of which are in colour. The principles and methods used by Michurin in the production of his hybrids are again described and lists are given of the varieties he has produced, firstly of the recognized varieties, secondly of the promising ones which have not yet come into bearing ; 136 varieties appear in the first group and 276 in the second, from which some idea may be gained of the remarkable scale of Michurin's work and achievements. In addition to the names of the varieties, their origin, specific names and areas of cultivation are indicated. There is also a list of the varieties and species which Michurin used as parents and a bibliography of his published works.
The volume is a tribute not only to the work of an outstanding and original scientist but to the system which made the full development of his work possible.

Taylor, H. V. 634.11(42)

The apples of England.
Crosby Lockwood and Son, Ltd., London, 1936 : 21s. 0d. Pp. 266 + xiii. 1 pl. 11 figs.

" The Apples of England " is the first volume in a new series of " Agricultural and Horticultural Handbooks " and it must be said from the first that it sets a high standard for the series.
The first part of the book, some eighty pages, deals with the general topics about apples such as

the meaning of the term " variety," which the author points out is not always a clone, and there is a chapter on the life of a variety, in which the question of whether a variety has a limited life is discussed. A historical chapter provides some very interesting reading, while of special interest to geneticists is a chapter on chromosomes in relation to fertilization and inheritance. Other topics covered are tree and leaf characters, blossom and fruit characters, the uses of apples and the classification of varieties. This part terminates with a bibliography and list of references. Part II, the remainder of the book, is devoted to an account of the varieties grown in England, especially those that are listed in nurserymen's catalogues. The difficult question of classification is avoided by arranging the varieties in alphabetical order. Under each variety is included a word or two about its origin, a technical description and a reference to an illustration when this is available.

The book terminates with an index to Part I.

The general impression gained from this delightful volume is that it is the work of a man who has both great experience and a great love for the subject. As such it forms most enjoyable reading, while as an authoritative account it will doubtless be indispensable to all concerned with apples.

LEBRUN, J. 634.37(67.5)

Les espèces Congolaises du genre *Ficus* L. (**The species of the genus *Ficus* L. found in the Congo**).

Marcel Hayez, Bruxelles 1934 : Pp. 79 : 4 figs.

The work represents a critical revision of the species of *Ficus* in the Congo based on Hutchinson [*Ficus*. (Flora Trop. Africa 1917 : **6**(2) : p. 78)] and includes a number of new species which have since been discovered.

Some of the seven sections of the sub-genera *Bibracteatae* of Mildbraed and Burret are retained. The geographical distribution of the genus is briefly noted as is also the economic importance of the species found in the Congo and finally 82 species are described, each with details of its distribution.

HERRMANN, E. 634.972.1

Merkblatt zur Unterscheidung der reinen Eichen-Arten Traubeneiche (*Quercus sessiliflora*) und Stieleiche (*Quercus pedunculata*). (**Distinctive characteristics of pure species of *Q. sessiliflora* and *Q. pedunculata***).

J. Neumann, Neudamm u. Berlin. RM. 0.20.† Pp. 3.

The particular features of the buds, leaves, petioles, capsules and acorns, that may be used to distinguish the two species of oak are arranged in parallel columns to facilitate identification. Life size illustrations of the leaves and acorns are also supplied as a further aid to diagnosis.

NEW JOURNALS.

The Nyasaland Tea Association.

Quarterly Journal.

To keep its members in touch with developments in general and with particular items of information which may be helpful to them in their work, the Nyasaland Tea Association has commenced publication of a quarterly journal.

The first issue consists largely of reprints of articles from other journals in different parts of the world, but it is to be hoped that the members themselves will not be backward in utilizing their new medium of expression. (Published by the Nyasaland Tea Association, Ltd., Victoria Avenue, Blantyre, Nyasaland.)

Statistical Research Memoirs.

While not strictly a periodical, the aim of the Editors of this series of Statistical Research Memoirs is to issue a volume of the size of the present one about once a year. The Memoirs contain only papers prepared in the Department of Statistics at University College, London, i.e. by the staff and students. Many statistical papers dealing with applications to many branches of

science find their natural place in the specialized journals belonging to those branches, but hitherto purely theoretical papers have been rather scattered over various journals. No doubt this will still continue, but it is undoubtedly a convenience to workers in the subject to have the researches emanating from this particular school accessible in one place.

The material of the first volume must no doubt seem rather formidable to biological workers whose mathematical knowledge is often limited, dealing as it does with the theoretical bases of tests of statistical hypotheses. But it is just these points on which theory must be sound before cut-and-dried rules are formulated for the guidance of experimentalists, who will watch with interest for the application of theory in practical tests of significance. The reputation of the Editors is enough to ensure that the high standard of the first volume will be maintained, while a tribute must also be paid to the excellence of the printing of the Cambridge University Press. The first volume is dedicated to Karl Pearson, who died on 27th April, 1936, " teacher and inspirer of innumerable research workers of many nations and races." (Edited by J. Neyman and E. S. Pearson. Published by the Department of Statistics, University College, London. Price 15s. 0d. net).

J.W.

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